Postgraduate Diploma

Radiophysics Applied to Nuclear Medicine

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Postgraduate Diploma
Radiophysics Applied to Nuclear Medicine

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

Website: **www.techtitute.com/pk/nursing/postgraduate-diploma/postgraduate-diploma-radiophysics-applied-nuclear-medicine**

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01

Introduction

In the field of radiation therapy, the calibration of activimeters is a substantial practice for nurses dealing with cancer treatments. These devices, used to measure radiation dose, ensure that therapies are administered as accurately as possible. They are also indispensable instruments for monitoring patients suffering from chronic conditions such as heart disease, diabetes or respiratory disorders. In this sense, calibration is key to tracking the evolution of conditions and thus adjusting care plans optimally. In this context, TECH has developed an advanced program that will address the keys to effectively use basic instrumentation in Nuclear Medicine.

You will delve into the interaction of radiation with organic tissues, through this innovative 100% online specialization"

Healthcare workers, especially those working in hospitals, are exposed to ionizing radiation on a daily basis, for example, by handling X-ray equipment to obtain X-rays. For this reason, it is important that staff follow the regulations established by international standards and implement radiation protection measures. In this way, physicians can guarantee maximum safety in the facilities, ensuring the well-being of both users and staff. To this end, specialists must update their knowledge in this field, keeping up to date with the recommendations of official bodies such as the Nuclear Safety Council.

In this context, TECH has implemented a pioneering program that will lay the foundations for hospital radiation protection. In this way, nurses will be up to date with the most effective tools to prevent risks in their work environment. Designed by an experienced faculty, the curriculum will focus on safety in the most exposed areas in hospitals: Nuclear Medicine, Radiodiagnostics and Radiation Oncology.

In addition, the syllabus will analyze in detail the calibration and verification procedures for instrumentation to control the hermeticity of encapsulated radioactive sources. It will also delve into the design and management of structural shielding, so that graduates can develop actions to prevent undesired exposures.

The academic itinerary will be based on the innovative Relearning system, a method that consists of reiterating key aspects in a gradual and natural way. In this way, they will students not have to resort to traditional tactics such as memorization. In addition, they will be able to access the Virtual Campus from any electronic device with Internet access. There they will have at their disposal groundbreaking materials, supplementary readings and numerous multimedia resources, such as explanatory videos, interactive summaries or infographics.

This **Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine** is the most complete and up-to-date scientific program on the market. Its most notable features are:

- The development of practical cases presented by experts in Radiophysics applied to Nuclear Medicine
- The graphic, schematic, and practical content 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

You will develop artificial radionuclides using generators to assess the function of specific organs, such as the endocrine system"

You will cover the operation of gamma cameras and positron emission tomography, the most important instrumentation of a Nuclear Medicine service"

Do you want to specialize in radiation protection in hospital facilities? Bet on TECH and aspire to the top.

Study at your own pace! The Relearning methodology used in this program will allow you to learn in an autonomous and progressive way.

The program's teaching staff includes professionals from the industry who contribute their work experience to this 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.

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Objectives

This Postgraduate Diploma will enable specialists to analyze the effects of ionizing radiation interaction with tissues and organs.

In this way, they will identify the main risks associated with exposures, using statistical models aimed at cell survival. They will also be able to base advanced concepts in dosimetry in patients, performing quality controls in emerging technologies, such as gamma cameras. In addition, professionals will be highly qualified to implement the most effective safety measures to avoid the harmful effects of radioactive materials.

You will develop a comprehensive knowledge of the MIRD methodology in patient dosimetry and perform the calculation of absorbed doses in different tissues"

General Objectives

- Analyze the basic interactions of ionizing radiation with tissues
- Establish the effects and risks of ionizing radiation at the cellular level
- Develop the existing mathematical models and their differences
- Determine the cellular response to various medical exposures
- Compile the instrumentation of a Nuclear Medicine Service
- Acquire knowledge of gamma cameras and PET
- Investigate the operation of both tomographs based on quality control
- Establish more advanced concepts of dosimetry in patients
- Analyze the existing risks derived from the use of ionizing radiation in Hospital Radioactive Facilities
- Delve into the international regulations applicable to radiation protection
- Specify the main safety actions in the use of ionizing radiation
- Generate the right knowledge for the design and management of shielding

A unique, key, and decisive experience to boost your professional development in only 6 months"

Specific Objectives

Module 1. Radiobiology

- Assess the risks associated with the main medical exposures
- Analyze the interaction of ionizing radiation with tissues and organs
- Examine the different existing mathematical models in radiobiology
- Establish the parameters that affect the biological response to ionizing radiation

Module 2. Nuclear Medicine

- Distinguish between modes of image acquisition from a patient with radiopharmaceuticals
- Establish the physical basis of gamma camera and PET performance
- Determine the quality controls between gamma cameras and PET
- Develop expertise on MIRD methodology in patient dosimetry

Module 3. Radiation Protection in Hospital Radioactive Facilities

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

03

Course Management

In order to offer maximum educational excellence, TECH has a renowned teaching team. These specialists have an extensive professional background, having been part of renowned hospitals. In addition, they are characterized for having a deep knowledge in Radiophysics Applied to Nuclear Medicine, offering the most advanced technological resources in the health field. In this way, the graduate will have the guarantees they need to update their skills and acquire new skills to provide quality service to their patients.

You will have the support of a teaching staff formed by distinguished professionals in Radiophysics Applied to Nuclear Medicine"

Management

Dr. De 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, Universidad Católica San Antonio de 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. Irazola Rosales, Leticia

- Specialist in Hospital Radiophysics
- Physician in Hospital Radiophysics at the Biomedical Research Center of La Rioja
- Working group on Lu-177 treatments at the Spanish Society of Medical Physics (SEFM)
- Collaborator in the University of Valencia
- Reviewer of the journal Applied Radiation and Isotopes
- International PhD in Medical Physics, University of Seville
- Master's Degree in Medical Physics from the University of Rennes I
- Degree in Physics from the Universidad de Zaragoza
- Member of: European Federation of Organisations in Medical Physics (EFOMP) and Spanish Society of Medical Physics (SEFM)

Dr. Rodríguez, Carlos Andrés

- Specialist in Hospital Radiophysics
- Physician in Hospital Radiophysics at the University Clinical Hospital of Valladolid, head of the Nuclear Medicine section.
- Principal Tutor of residents of the Department of Radiophysics and Radiological Protection of the Hospital Clínico Universitario de Valladolid.
- Degree in Hospital Radiophysics
- Degree in Physics at the University of Salamanca

04

Structure and Content

This syllabus is a guide for students to handle the basic tools in Radiobiology, applicable to clinical practice. Accordingly, the syllabus will analyze the interaction of ionizing radiation with biological tissues, using mathematical models of cell survival. It will also delve into the most important instrumentation of a Nuclear Medicine service, such as tomographs or activimeters. In this line, the program will emphasize the importance of radiological protection in hospital facilities, to ensure the safety of both patients and health workers.

You will follow the chain of effects produced by the interaction of ionizing radiation at the cellular level, appreciating its consequences in biological matters"

Module 1. Radiobiology

1.1. Interaction of Radiation with Organic Tissues
- 1.1.1. Interaction of Radiation with Tissues
- 1.1.2. Interaction of Radiation with Cells
- 1.1.3. Physical-Chemical Response

1.2. Effects of Ionizing Radiation on DNA
- 1.2.1. Structure of ADN
- 1.2.2. Radiation-induced Damage
- 1.2.3. Damage Repair

1.3. Effects of Radiation on Organic Tissues
- 1.3.1. Effects on the Cell Cycle
- 1.3.2. Irradiation Syndromes
- 1.3.3. Aberrations and Mutations

1.4. Mathematical Models of Cell Survival
- 1.4.1. Mathematical Models of Cell Survival
- 1.4.2. Alpha-Beta Model
- 1.4.3. Effect of Fractionation

1.5. Efficacy of Ionizing Radiations on Organic Tissues
- 1.5.1. Relative Biological Efficacy
- 1.5.2. Factors Altering Radiosensitivity
- 1.5.3. LET and Oxygen Effect

1.6. Biological Aspects according to the Dose of Ionizing Radiations
- 1.6.1. Radiobiology at Low Doses
- 1.6.2. Radiobiology at High Doses
- 1.6.3. Systemic Response to Radiation

1.7. Estimation of the Risk of Ionizing Radiation Exposure
- 1.7.1. Stochastic and Random Effects
- 1.7.2. Risk Estimation
- 1.7.3. ICRP Dose Limits

1.8. Radiobiology in Medical Exposures in Radiotherapy
- 1.8.1. Isoeffect
- 1.8.2. Proliferation Effect
- 1.8.3. Dose-Response

1.9. Radiobiology in Medical Exposures in Other Medical Exposures
- 1.9.1. Brachytherapy
- 1.9.2. Radiodiagnostics
- 1.9.3. Nuclear medicine

1.10. Statistical Models in Cell Survival
- 1.10.1. Statistical Models
- 1.10.2. Survival Analysis
- 1.10.3. Epidemiological Studies

Module 2. Nuclear Medicine

2.1. Radionuclides used in Nuclear Medicine
- 2.1.1. Radionuclides
- 2.1.2. Typical Diagnostic Radionuclides
- 2.1.3. Typical Therapy Radionuclides

2.2. Typical Radionuclides in Therapy
- 2.2.1. Obtaining Artificial Radionuclides
- 2.2.2. Cyclotron
- 2.2.3. Generators

2.3. Instrumentation in Nuclear Medicine
- 2.3.1. Activimeters. Calibration of Activimeters
- 2.3.2. Intraoperative Probes
- 2.3.3. Gamma Camera and SPECT
- 2.3.4. PET:

2.4. Quality Assurance Program in Nuclear Medicine
- 2.4.1. Quality Assurance in Nuclear Medicine
- 2.4.2. Acceptance, Reference and Constancy Tests
- 2.4.3. Good Practice Routine

2.5. Nuclear Medicine Equipment: Gamma Cameras
- 2.5.1. Image Formation
- 2.5.2. Image Acquisition Modes
- 2.5.3. Standard Patient Protocol

2.6. Nuclear Medicine Equipment: SPECT
- 2.6.1. Tomographic Reconstruction
- 2.6.2. Synogram
- 2.6.3. Reconstruction Corrections

2.7. Nuclear Medicine Equipment: PET:
- 2.7.1. Physical Basis
- 2.7.2. Detector Material
- 2.7.3. 2D and 3D Acquisition. Sensitivity
- 2.7.4. Time of Flight

2.8. Image Reconstruction Corrections in Nuclear Medicine
- 2.8.1. Attenuation Correction
- 2.8.2. Dead Time Correction
- 2.8.3. Random Event Correction
- 2.8.4. Scattered Photon Correction
- 2.8.5. Standardization
- 2.8.6. Image Reconstruction

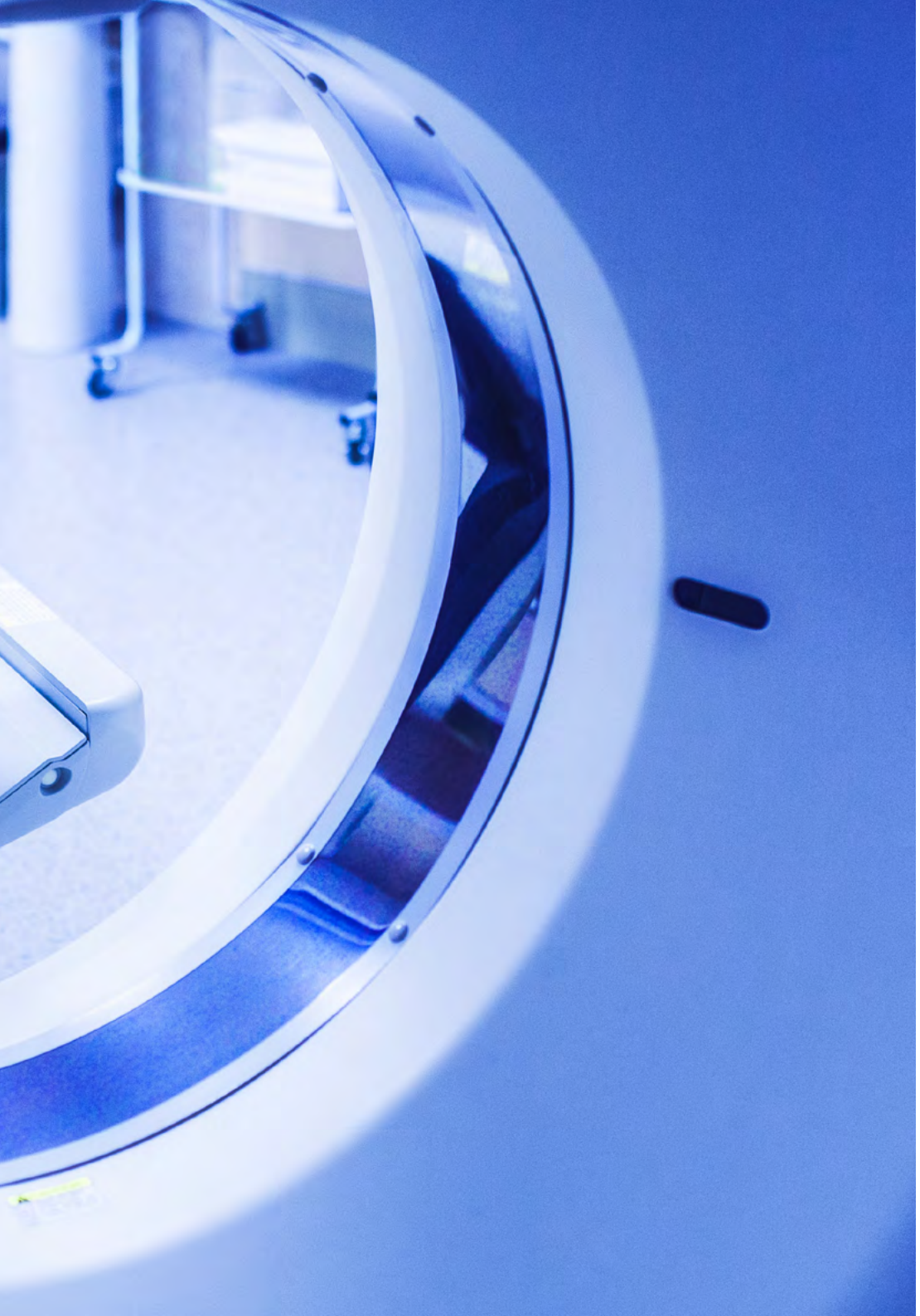
2.9. Quality Control of Nuclear Medicine Equipment
- 2.9.1. International Guidelines and Protocols
- 2.9.2. Planar Gamma Cameras
- 2.9.3. Tomographic Gamma Cameras
- 2.9.4. PET:

2.10. Dosimetry in Nuclear Medicine Patients
- 2.10.1. MIRD Formalism
- 2.10.2. Uncertainty Estimation
- 2.10.3. Erroneous Administration of Radiopharmaceuticals

Module 3. Radiation Protection in Hospital Radioactive Facilities

3.1. Radiation Protection in Hospitals
- 3.1.1. Radiation Protection in Hospitals
- 3.1.2. Radiological Protection Magnitudes and Specialized Radiation Protection Units
- 3.1.3. Risks in the Hospital Area

3.2. International Radiation Protection Standards
- 3.2.1. International Legal Framework and Authorizations
- 3.2.2. International Regulations on Health Protection against Ionizing Radiation
- 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. Tightness Control of Encapsulated Radioactive Sources
- 3.6.1. Tightness Control 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 Facilities
- 3.8.3. Calculation of the Workload

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

3.10. Structural Shielding Design in Radiodiagnostics
- 3.10.1. Structural Shielding Design in Radiodiagnostics
- 3.10.2. Radiodiagnostics Facilities
- 3.10.3. Calculation of the Workload

05

Methodology

This 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"

At TECH Nursing School we use the Case Method

In a given situation, what should a professional do? Throughout the program, students will face multiple simulated clinical cases, based on real patients, in which they will have to do research, establish hypotheses, and ultimately resolve the situation. There is an abundance of scientific evidence on the effectiveness of the method. Nurses learn better, faster, and more sustainably over time.

With TECH, nurses can experience a learning methodology that is shaking the foundations of traditional universities around the world.

According to Dr. Gérvas, the clinical case is the annotated presentation of a patient, or group of patients, which becomes a "case", an example or model that illustrates some peculiar clinical component, either because of its teaching power or because of its uniqueness or rarity. It is essential that the case is based on current professional life, in an attempt to recreate the real conditions in professional nursing practice.

Did you know that this method was developed in 1912, at Harvard, for law students? The case method consisted of presenting students with real-life, complex situations for them to make decisions and justify their decisions on how to solve them. In 1924, Harvard adopted it as a standard teaching method.

The effectiveness of the method is justified by four fundamental achievements:

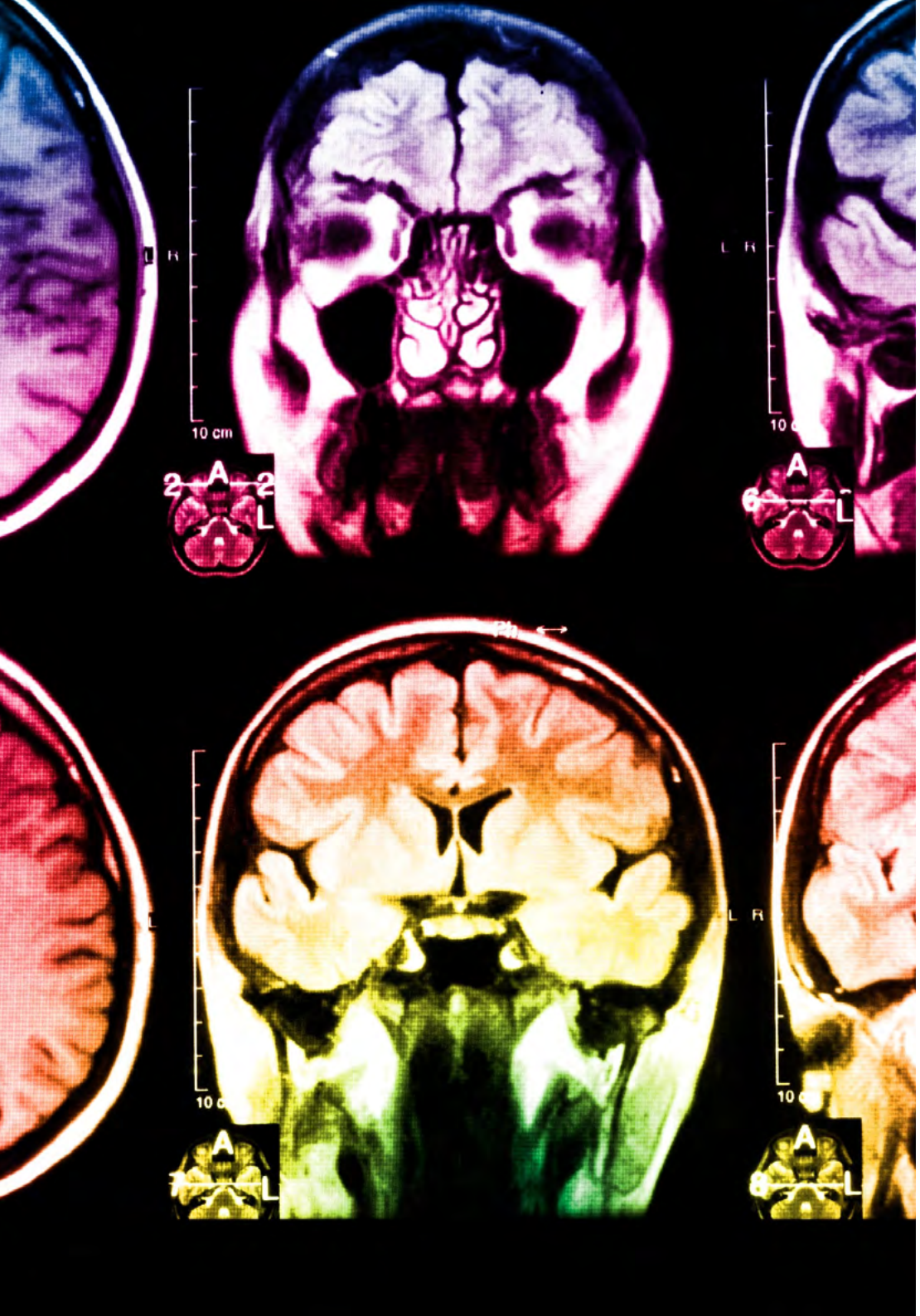
1. Nurses who follow this method not only grasp concepts, but also develop their mental capacity, by evaluating real situations and applying their knowledge.
2. The learning process has a clear focus on practical skills that allow the nursing professional to better integrate knowledge acquisition into the hospital setting or primary care.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.

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.

The nurse will learn through real cases and by solving complex situations in simulated learning environments. These simulations are developed using state-of-the-art software to facilitate immersive learning.



At the forefront of world teaching, the Relearning method has managed to improve the overall satisfaction levels of professionals who complete their studies, with respect to the quality indicators of the best online university (Columbia University).

With this methodology we have prepared more than 175,000 nurses with unprecedented success in all specialities regardless of practical workload. Our educational methodology is developed in a highly competitive environment, with a university student body with a strong socioeconomic profile and an average age of 43.5 years old.

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

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.

The overall score obtained by TECH's learning system is 8.01, according to the highest international standards.

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 really specific and precise.

These contents are then adapted in 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.

Nursing Techniques and Procedures on Video

We introduce you to the latest techniques, to the latest educational advances, to the forefront of current medical techniques. All of this in direct contact with students and explained in detail so as to aid their assimilation and understanding. And best of all, you can watch them as many times as you want.

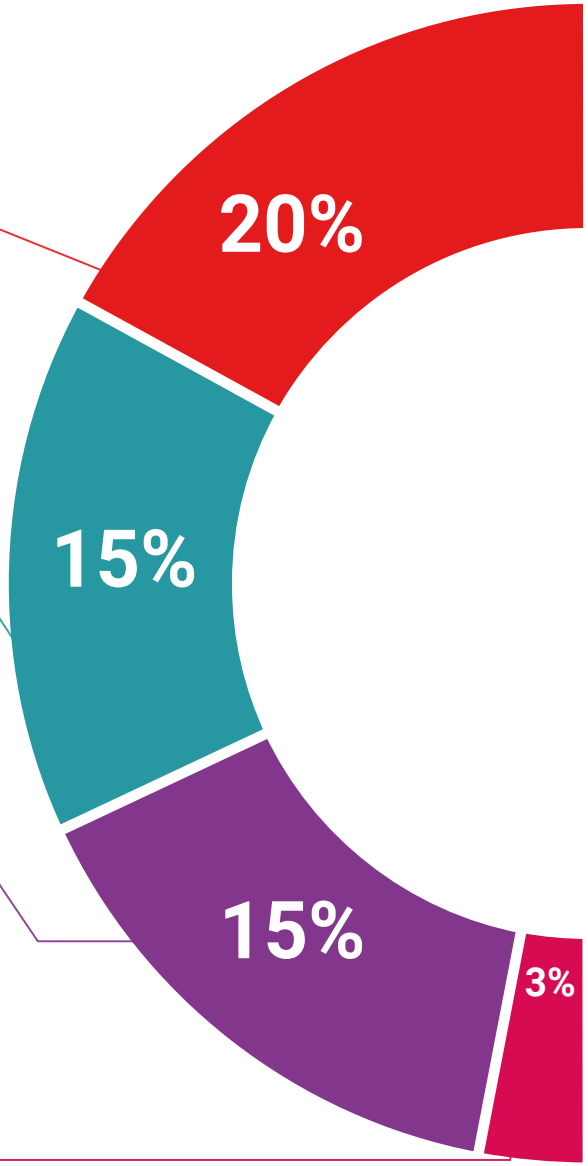
Interactive Summaries

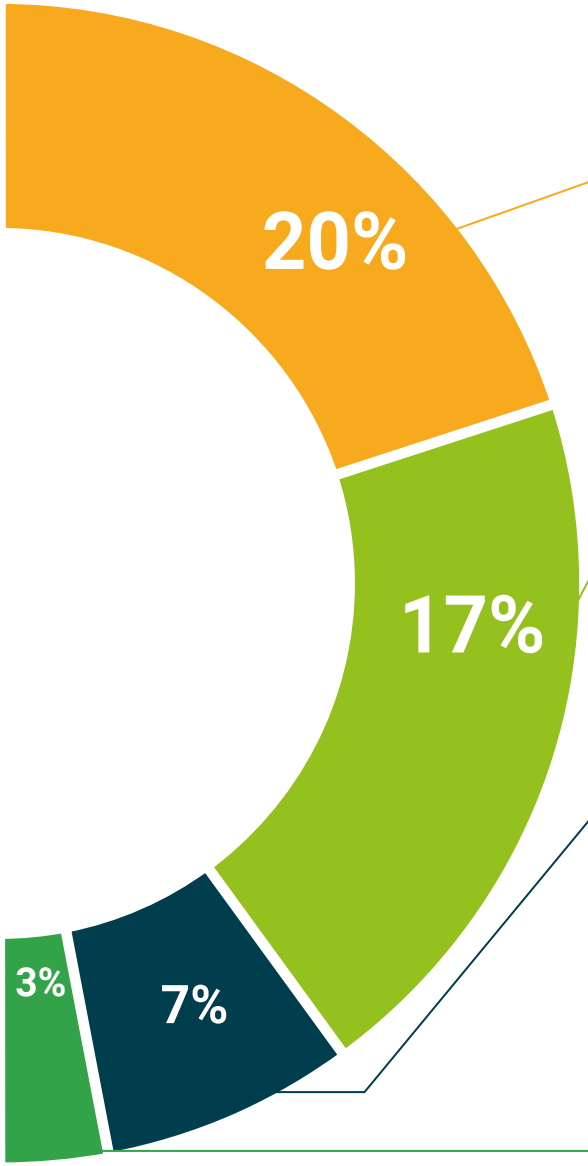
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

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.





Expert-Led Case Studies and Case Analysis

Effective learning ought to be contextual. Therefore, TECH presents real cases in which the expert will guide students, focusing on and solving the different situations: a clear and direct way to achieve the highest degree of understanding.

Testing & Retesting

The student's knowledge is periodically assessed and re-assessed throughout the program, through evaluative and self-evaluative activities and exercises: in this way, students can check how they are doing in terms of achieving their goals.

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.

Quick Action Guides

TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical and effective way to help students progress in their learning.

06

Certificate

The Postgraduate Diploma in Radiophysics Applied to Nuclear Medicine guarantees, in addition to the most rigorous and up to date knowledge, 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 Radiophysics Applied to Nuclear Medicine** is the most complete and up-to-date scientific 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 certificate 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 Radiophysics Applied to Nuclear Medicine**

Official Nº of Hours: **450 h.**


tech technological university

Awards the following

CERTIFICATE

to

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

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Radiophysics Applied to Nuclear Medicine

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 certificate issued with an apostille, TECH EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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Postgraduate Diploma

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