Postgraduate Diploma

Radiophysics Applied to Radiotherapy

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Postgraduate Diploma
Radiophysics Applied to Radiotherapy

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

Website: www.techtitute.com/us/medicine/postgraduate-diploma/postgraduate-diploma-radiophysics-applied-radiotherapy

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01

Introduction

Radiophysics Applied to Radiotherapy is a crucial branch in the field of oncological medicine, since its precise and personalized approach allows the delivery of therapeutic doses of radiation with high precision, which enhances the effectiveness of treatment by specifically targeting the cancerous tissue.

This discipline also prioritizes the protection of surrounding healthy tissues, thus reducing unwanted side effects. For these reasons, TECH has worked to offer physicians a comprehensive program, specializing them in the use of radiation to optimize the diagnosis and treatment of numerous pathologies. Thanks to the revolutionary Relearning methodology and the 100% online modality, graduates will have the flexibility to adapt to their own schedules.

Thanks to this program in Radiophysics Applied to Radiotherapy, you will guarantee the maximum effectiveness of your treatments"

Radiophysics Applied to Radiotherapy focuses on the application of physical principles, such as the interaction of radiation with matter and dosimetry, to design treatment plans that maximize the dose to tumor tissue, while exposure to surrounding healthy tissues is minimized. This is why specialized radiophysicists are in such high demand, as they employ advanced technologies such as image-guided radiotherapy, to ensure accurate delivery of the prescribed dose.

This is how this Postgraduate Diploma was created, thanks to which the physician will deal with the interaction of ionizing radiation with biological tissues, the resulting cellular and biological effects, as well as the repair mechanisms and the evaluation of the relative biological efficiency of various ionizing radiations. In addition, this program will provide fundamental knowledge for clinical practice in external radiotherapy, highlighting the importance of radioprotection and the management of risks associated with these radiations.

Likewise, physical dosimetry, essential in external radiotherapy to characterize the radiation beams used in clinical treatments, will be delved into. Emphasis will also be placed on the quality assurance program, detailing the necessary controls on the equipment and the minimum requirements to ensure safe treatments consistent with the plans.

Another key component is clinical dosimetry, with particular emphasis on the use of computerized problem-solving tools. In addition, all stages of the radiotherapeutic process will be studied in detail, including simulation, treatment with linear electron accelerators, and dose verification for intensity-modulated therapies, where the intensity of the radiation beam is modulated to obtain non-homogeneous dose distributions.

In this way, TECH has developed a complete exhaustive system based on the innovative *Relearning* methodology, based on the repetition of fundamental ideas to ensure an optimal understanding of the content. Likewise, the graduate will only need an electronic device with an Internet connection to access all the resources.

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

- The development of practical cases presented by experts in Radiophysics applied to Radiotherapy
- The graphic, schematic and practical contents with which it is conceived gather scientific and practical information on those 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

Mastering advanced technologies, such as computed tomography, will allow you to contribute to cure rates and quality of life for your patients"

With this 100% online program you will delve into the physical principles behind external beam therapy and the physical dosimetry used to deliver precise doses of radiation"

You will analyze the concepts of effective dose, stochastic and non-stochastic effects, and the radiobiology of normal and cancerous tissues. Enroll now!

You will apply physical dosimetry in external radiotherapy, considering clinical cases and treatment optimization, all through the most innovative multimedia resources.

The program's teaching staff includes professionals from the sector 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.

02

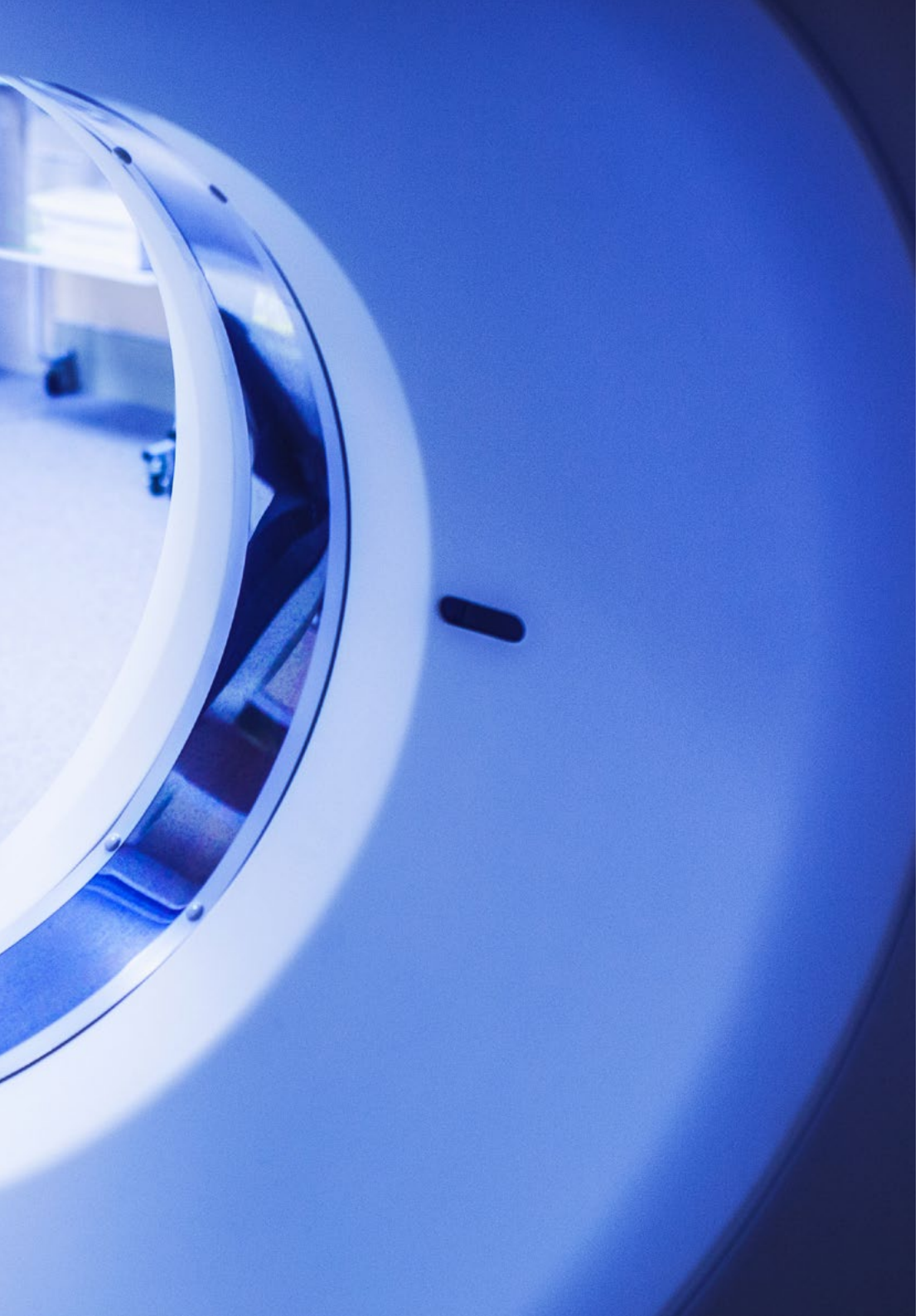
Objectives

The main goal of the program is to specialize professionals in Radiobiology, Physical and Clinical Dosimetry, and in the advanced management of radiotherapeutic technologies. Upon completion of this Postgraduate Diploma, graduates will not only acquire solid knowledge in the interaction of ionizing radiation with biological tissues, but also practical skills to plan and administer radiotherapeutic treatments in a precise and safe manner. In this way, you will highlight the importance of radioprotection, quality in dose administration and the efficient use of computer tools to solve clinical challenges.

Become a committed leader to the advancement of oncology medicine, driving crucial advances in the fight against cancer"

General Objectives

- Investigate the the basic interactions of ionizing radiation with tissues
- Establish the effects and risks of ionizing radiation at the cellular level
- Determine the cellular response these effects to various medical exposures
- Specify the equipment used in external radiotherapy treatments
- Develop the steps to initiate treatments with external radiotherapy equipment
- Analyze the elements used in photon and electron beam measurement for the treatment of external radiotherapy
- Examine the quality control program
- Analyze the evolution of clinical dosimetry in external radiotherapy over the years
- Delve into the different stages of external radiotherapy treatment
- Delve into the characteristics of treatment planning systems
- Identify the different treatment planning techniques for external radiotherapy treatment planning techniques
- Apply specific quality controls for the verification of treatment plans



Specific Objectives

Module 1. Radiobiology

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

Module 2. External Radiotherapy. Physical Dosimetry

- Set up simulation, localization and image-guided radiotherapy Different equipment
- Develop photon beam and electron beam calibration procedures
- Examine the quality control program of radiotherapy equipment

Module 3. External Radiotherapy. Clinical Dosimetry

- Specify the different characteristics of the types of external radiotherapy treatments
- Develop quality control procedures for the planning systems
- Examine the tools that allow external radiotherapy planning evaluation
- Analyze the different verification systems of external radiotherapy plans, as well as the metrics used

03

Course Management

The faculty of the Postgraduate Diploma in Radiophysics Applied to Radiotherapy are leaders at the forefront of Oncological Medicine, combining practical experience and theoretical knowledge to offer exceptional knowledge. These highly specialized professionals not only have a solid academic background, but are immersed in the constant innovation of radiotherapeutic technologies. They are committed to guiding graduates to excellence by imparting technical information and a passion for precision, ethics in patient care, and a drive to make a significant contribution to the improvement of oncology treatments.

The best faculty will guide you in your journey through the Postgraduate Diploma in Radiophysics Applied to Radiotherapy, with the guarantee of quality of TECH"

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, Universidad Católica San Antonio de Murcia
- Ph.D. 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 Ph.D. 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. Morera Cano, Daniel

- Specialist in Hospital Radiophysics
- Hospital Radiophysics Faculty at the University Hospital Son Espases
- Master's Degree in Industrial Safety and Environment by the Polytechnic University of Valencia
- Master's Degree in Radiological Protection in Radioactive and Nuclear Facilities
- Degree in Industrial Engineering from the Polytechnic University of Valencia

Ms. Milanés Gaillet, Ana Isabel

- Radiophysicist at the University Hospital 12 de Octubre
- Medical Physicist at the Beata María Ana Hospital of Hermanas Hospitalarias
- Expert in Radiological Anatomy and Physiology from the Spanish Society of Medical Physics
- Expert in Medical Physics from the International University of Andalusia
- Degree in Physics from the Autonomous University of Madrid

04

Structure and Content

This academic program has a rigorous and complete structure, designed to specialize highly qualified professionals in Applied Radiophysics. In this way, its content will cover from the fundamentals of Radiobiology to Clinical Dosimetry, guiding physicians through modules that will explore the interaction of radiation with biological tissues, the advanced management of radiotherapeutic technologies and accurate treatment planning. This program combines theoretical knowledge with practical applications, emphasizing the importance of professional ethics, constant innovation and commitment to excellence in patient care.

You will acquire specialized knowledge for clinical practice in the different areas where ionizing radiation is present"

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 DNA
- 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. External Radiotherapy. Physical Dosimetry

2.1. Linear Electron Accelerator. Equipment in External Radiotherapy
- 2.1.1. Linear Electron Accelerator (LEA)
- 2.1.2. External Radiotherapy Treatment Planner (TPS)
- 2.1.3. Record Keeping and Verification System
- 2.1.4. Special Techniques
- 2.1.5. Hadrontherapy

2.2. Simulation and Localization Equipment in External Radiation Therapy
- 2.2.1. Conventional Simulator
- 2.2.2. Computed Tomography (CT) Simulation
- 2.2.3. Other Image Modalities

2.3. Image-guided External Radiation Therapy Equipment
- 2.3.1. Simulation equipment
- 2.3.2. Image-guided Radiotherapy Equipment. CBCT
- 2.3.3. Image-guided Radiotherapy Equipment. Planar Image
- 2.3.4. Auxiliary Localization Systems

2.4. Photon Beams in Physical Dosimetry
- 2.4.1. Measuring Equipment
- 2.4.2. Calibration Protocols
- 2.4.3. Calibration of Photon Beams
- 2.4.4. Relative Dosimetry of Photon Beams

2.5. Electron Beams in Physical Dosimetry
- 2.5.1. Measuring Equipment
- 2.5.2. Calibration Protocols
- 2.5.3. Calibration of Electron Beams
- 2.5.4. Relative Dosimetry of Electron Beams

2.6. Implementation of External Radiotherapy Equipment
- 2.6.1. Installation of External Radiotherapy Equipment
- 2.6.2. Acceptance of External Radiotherapy Equipment
- 2.6.3. Initial Reference Status (IRS)
- 2.6.4. Clinical Use of External Radiotherapy Equipment
- 2.6.5. Treatment Planning Systems

2.7. Quality Control of External Radiotherapy Equipment
- 2.7.1. Quality Control of Linear Accelerators
- 2.7.2. Quality Control in the IGRT Equipment
- 2.7.3. Quality Control in Simulation Systems
- 2.7.4. Special Techniques

2.8. Quality Control of Radiation Measuring Equipment
- 2.8.1. Dosimetry
- 2.8.2. Measuring Tools
- 2.8.3. Mannequins Employed

2.9. Application of Risk Analysis Systems in External Radiation Therapy
- 2.9.1. Risk Analysis Systems
- 2.9.2. Error Reporting Systems
- 2.9.3. Process Mapping

2.10. Quality Assurance Programming in Physical Dosimetry
- 2.10.1. Responsibilities
- 2.10.2. Requirements in External Radiotherapy
- 2.10.3. Quality Assurance Programming Clinical and Physical Aspects
- 2.10.4. Maintenance of Quality Control Program

Module 3. External Radiotherapy. Clinical Dosimetry

3.1. Clinical Dosimetry in External Radiotherapy
- 3.1.1. Clinical Dosimetry in External Radiotherapy
- 3.1.2. Treatment in External Radiotherapy
- 3.1.3. Beam Modifying Elements

3.2. Stages of Clinical Dosimetry of External Radiotherapy
- 3.2.1. Simulation Stage
- 3.2.2. Treatment Planning.
- 3.2.3. Treatment Verification
- 3.2.4. Linear Electron Accelerator Treatment

3.3. Treatment Planning Systems in External Radiotherapy
- 3.3.1. Models in Planning Systems
- 3.3.2. Calculating Algorithms
- 3.3.3. Utilities of Planning Systems
- 3.3.4. Imaging Tools for Planning Systems

3.4. Quality Control of Planning Systems in External Radiotherapy
- 3.4.1. Quality Control of Planning Systems in External Radiotherapy
- 3.4.2. Initial Reference State
- 3.4.3. Periodic Controls

3.5. Manual Calculation of Monitor Units (MUs)
- 3.5.1. Manual Control of MUs
- 3.5.2. Intervening Factors in Dose Distribution
- 3.5.3. Practical Example of Calculation of UMs

3.6. Conformal 3D Radiotherapy Treatments
- 3.6.1. 3D Radiotherapy (RT3D)
- 3.6.2. Photon Beam RT3D Treatments
- 3.6.3. Electron Beam RT3D Treatments

3.7. Advanced Intensity Modulated Treatments
- 3.7.1. Modulated Intensity Treatments
- 3.7.2. Optimization
- 3.7.3. Specific Quality Control

3.8. Evaluation of External Radiation Therapy Planning
- 3.8.1. Dose-volume Histogram
- 3.8.2. Conformation Index and Homogeneity Index
- 3.8.3. Clinical Impact of the Planning
- 3.8.4. Planning Errors

3.9. Advanced Special Techniques in External Radiotherapy
- 3.9.1. Radiosurgery and Extracranial Stereotactic Radiotherapy
- 3.9.2. Total Body Irradiation
- 3.9.3. Total Body Surface Irradiation
- 3.9.4. Other Technologies in External Radiotherapy

3.10. Verification of Treatment Plans in External Radiotherapy
- 3.10.1. Verification of Treatment Plans in External Radiotherapy
- 3.10.2. Treatment Verification Systems
- 3.10.3. Treatment Verification Metrics

Thanks to the revolutionary Relearning methodology, you will integrate all the knowledge in an optimal way to successfully achieve the results you are looking for"

05

Methodology

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

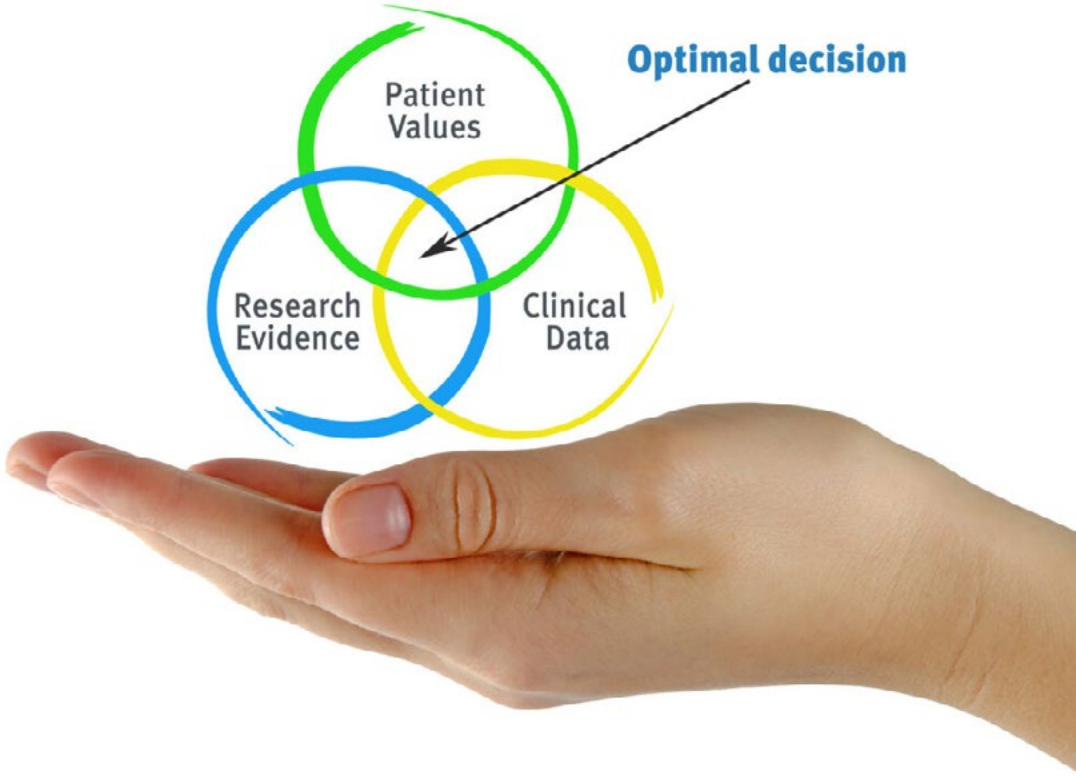
This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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"

At TECH we use the Case Method

What should a professional do in a given situation? 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. Specialists learn better, faster, and more sustainably over time.

With TECH you will experience a way of learning 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, trying to recreate the real conditions in the physician's professional 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:

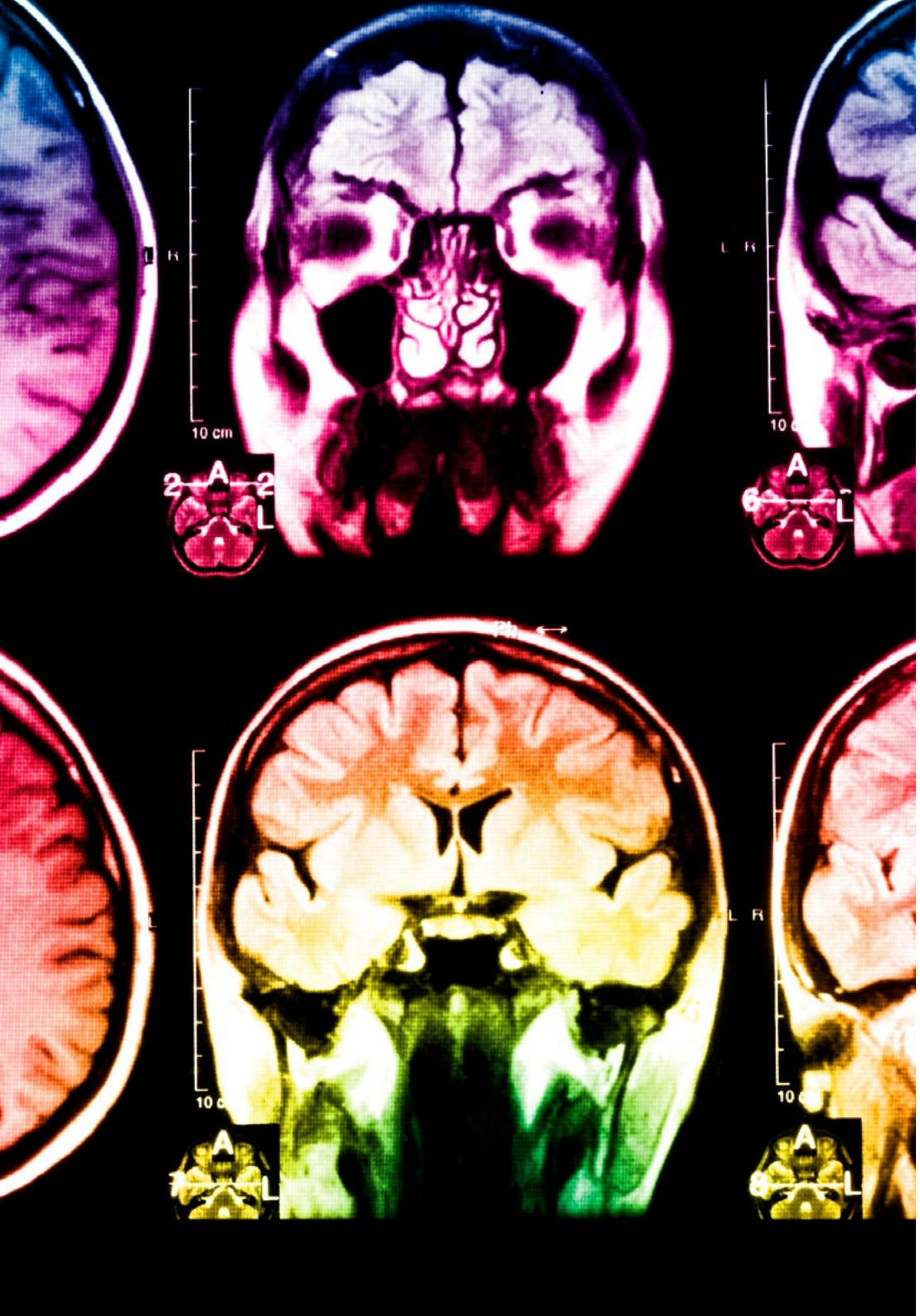
1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that evaluate real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
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

At TECH we enhance the case method with the best 100% online teaching methodology available: Relearning.

This university is the first in the world to combine the study of clinical cases with a 100% online learning system based on repetition, combining a minimum of 8 different elements in each lesson, a real revolution with respect to the mere study and analysis of cases.

Professionals will learn through real cases and by resolving 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, more than 250,000 physicians have been trained with unprecedented success in all clinical specialties regardless of surgical load. Our pedagogical 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 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.

Surgical Techniques and Procedures on Video

TECH introduces students to the latest techniques, the latest educational advances and 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 the videos as many times as you like.

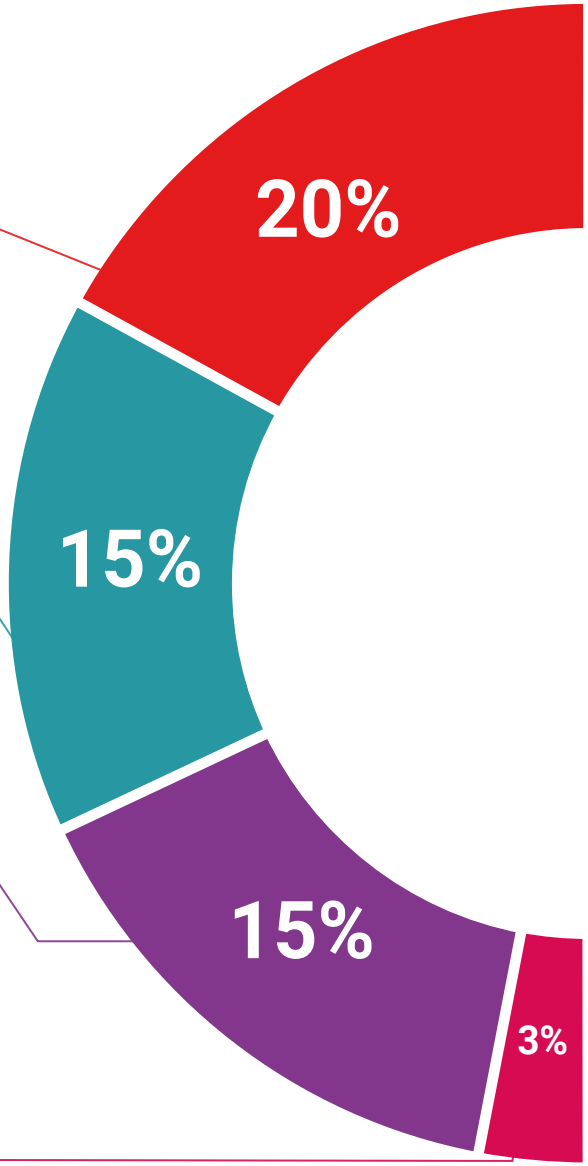
Interactive Summaries

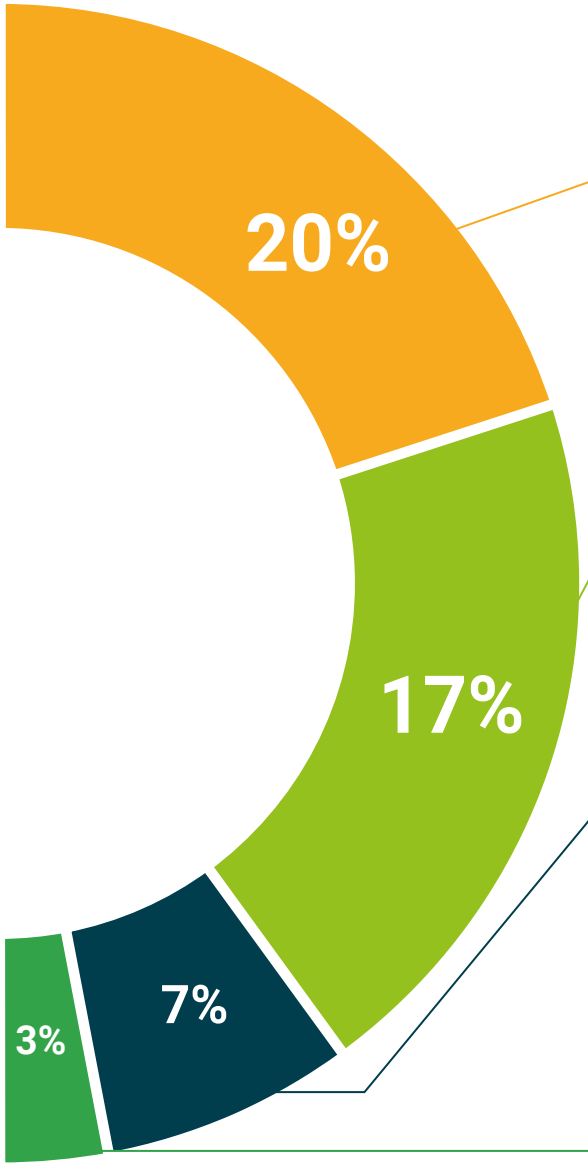
The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

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.

Classes

There is scientific evidence on the usefulness of learning by observing experts. The system known as 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 Radiotherapy 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 Radiophysics Applied to Radiotherapy** contains the most complete and up-to-date scientific 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 Radiophysics Applied to Radiotherapy**

Official Nº of Hours: **450 h.**


tech technological university

Awards the following

DIPLOMA

to

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

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Radiophysics Applied to Radiotherapy

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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