Professional Master's Degree

Radiophysics

tech technological university

Professional Master's Degree
Radiophysics

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

Website: **www.techtitute.com/pk/medicine/professional-master-degree/master-radiophysics**

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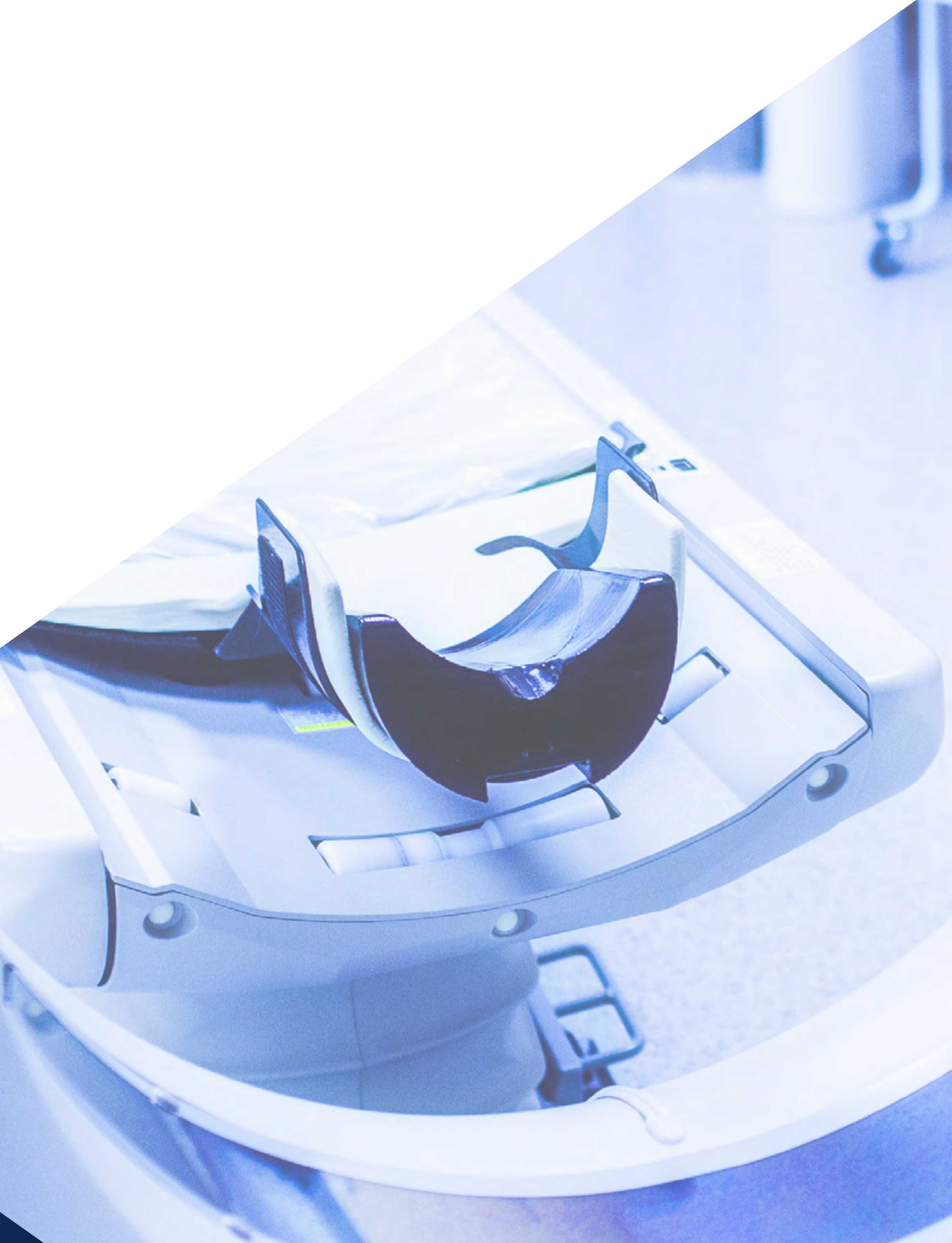
01

Introduction

Radiophysics plays a fundamental role in the field of medicine, since it applies physical principles in the diagnosis and treatment of diseases. Thanks to it, innovative technologies such as Computed Tomography or Magnetic Resonance Imaging are developed, which allow a more detailed image diagnosis of the interior of the human body, facilitating the early detection of pathologies. Taking into account all applications, TECH offers this program, thanks to which the physician can delve deeper into the most innovative techniques and tools in this field and implement them in the diagnosis and treatment of multiple pathologies, such as cancer. In addition, the university degree has a convenient 100% online format that allows graduates to expand their competencies in the field.



Through this Professional Master's Degree in Radiophysics, you will optimize diagnostic and therapeutic precision with radiation, improving the quality of life of patients"

The application of Radiophysics in Medicine has proven to be vital for the diagnosis and treatment of various pathologies, providing a significant contribution to the field of health. In diagnosis, it allows for precise and detailed images of internal structures of the body, allowing for the early detection of diseases. Furthermore, in oncological treatment, this discipline enables the administration of precise doses of radiation to malignant tumors.

For these reasons, TECH offers physicians this Professional Master's Degree in Radiophysics, offering a comprehensive approach to the fundamentals and applications of radiation in the medical field. In this way, the graduate will delve into the principles and advanced techniques for measuring radiation, including the study of detectors, units of measurement and calibration methods. Radiobiology will also be key to understanding the interaction of radiation with biological tissues and its effects on health, as well as the approach to the radiobiology of normal and cancerous tissues.

Likewise, professionals will cover, from physical principles, to clinical dosimetry and the application of advanced techniques, such as Proton Therapy. Not forgetting techniques such as Intraoperative Radiotherapy and Brachytherapy, detailing their physical foundations, as well as their clinical applications.

In addition, the course will explore diagnostic imaging, covering the physics behind medical imaging, different techniques and even dosimetry in radiodiagnostics. It will also include fields such as magnetic resonance and ultrasound, which do not use ionizing radiation. Nuclear Medicine, on the other hand, will be immersed in the use of radiotracers for the diagnosis and treatment of diseases. Finally, safety measures, regulations and safe practices in medical environments will be developed.

TECH has conceived a comprehensive program, based on the revolutionary *Relearning* methodology, consisting of the repetition of key concepts to ensure a solid understanding. You will only need an electronic device with an Internet connection to access the contents at any time.

This **Professional Master's Degree in Radiophysics** contains the most complete and up-to-date scientific program on the market. Its most notable features are:

- The development of case studies presented by experts in Radiophysics
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where the self-assessment process can be carried out to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Thanks to TECH and this program, you will use the physical principles and advanced technologies to apply ionizing and non-ionizing radiation in the medical field"

You will delve into the technique of Proton therapy, used to maximize radiation dose deposition in the treatment area, minimizing it on adjacent organs"

You will learn about gamma cameras and PET, the most important instrumentation of a Nuclear Medicine Department, in an agile and simple way.

You will master clinical dosimetry to achieve an optimal distribution of dose absorbed by the patient, through an extensive library of multimedia resources.

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.

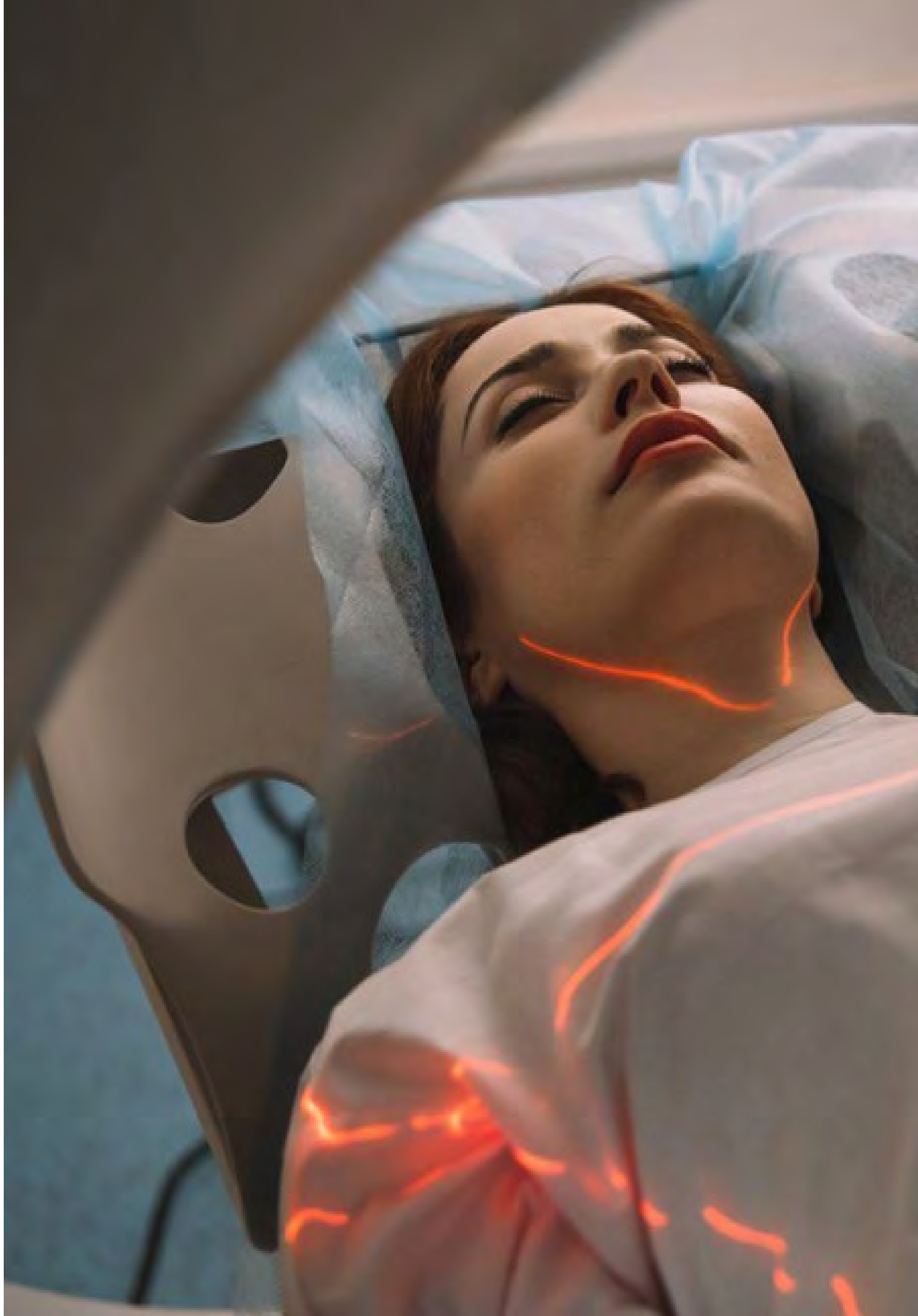
02
Objectives

The main objective of this program in Radiophysics will be to build solid theoretical knowledge, as well as to develop practical skills, essential to play a crucial role in the diagnosis and treatment of diseases using ionizing radiation. Therefore, the physician will cover from the physical and biological principles of radiation to Radiobiology and Dosimetry, contributing to diagnostic accuracy and treatment evaluation. Likewise, the professional will ensure radiological protection in medical environments, ensuring the safety of patients and staff. In addition, the focus on innovation, updating and research possibilities will contribute directly to public health.

You will excel in the field of Medicine and Radiation, bringing advances that will transform medical practice and health care"

General Objectives

- Analyze the basic interactions of ionizing radiation with tissues
- Establish the effects and risks of ionizing radiation at the cellular level
- Analyze elements of photon and electron beam measurement in external radiotherapy
- Examine the quality control program
- Identify the different treatment planning techniques for external radiotherapy treatment planning techniques
- Analyze the interactions of protons with matter
- Examine radiation protection and radiobiology in Proton Therapy
- Analyze the technology and equipment used in intraoperative radiation therapy
- Examine the clinical outcomes of Brachytherapy in different oncological contexts
- Analyze the importance of the Radiological Protection
- Assimilate the existing risks derived from the use of ionizing radiation
- Develop the international regulations applicable to radiation protection



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

Module 2. 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

Module 3. External Radiotherapy. Physical Dosimetry
- Examine the quality control program of radiotherapy equipment

Module 4. External Radiotherapy. Clinical Dosimetry
- Specify the different characteristics of the different types of external radiotherapy treatments
- Analyze the different verification systems of external radiotherapy plans, as well as the metrics used

Module 5. Advanced Radiotherapy Method. Proton Therapy
- Analyze proton beams and their clinical use
- Evaluate the necessary requirements for the characterization of this radiotherapy technique
- Establish the differences of this modality with conventional radiotherapy both technologically and clinically

Module 6. Advanced Radiotherapy Method. Intraoperative Radiotherapy

- Identify the main clinical indications for the application of intraoperative radiotherapy
- Analyze in detail the methods of dose calculation in intraoperative radiotherapy
- Examine the factors influencing patient and medical staff safety during intraoperative radiotherapy procedures

Module 7. Brachytherapy in the Field of Radiotherapy

- Examine the application of the Monte Carlo Method in Brachytherapy
- Evaluate planning systems using the TG 43 formalism
- Dose planning in Brachytherapy
- Identify and analyze the key differences between High Dose Rate (HDR) and Low Dose Rate Brachytherapy (LDR)
- Module 8. Advanced Diagnostic Imaging
- Develop specialized knowledge about the operation of an X-ray tube and a digital image detector
- Identify the different types of radiological images (static and dynamic), as well as the advantages and disadvantages offered by the various technologies currently available
- Analyze the international protocols for quality control of radiology equipment
- Delve into the fundamental aspects in the dosimetry of patients undergoing radiological tests

Module 9. Nuclear Medicine

- Distinguish between modes of image acquisition from a patient with radiopharmaceuticals
- Develop expertise on MIRD methodology in patient dosimetry

Module 10. Radiation Protection in Hospital Radioactive Facilities

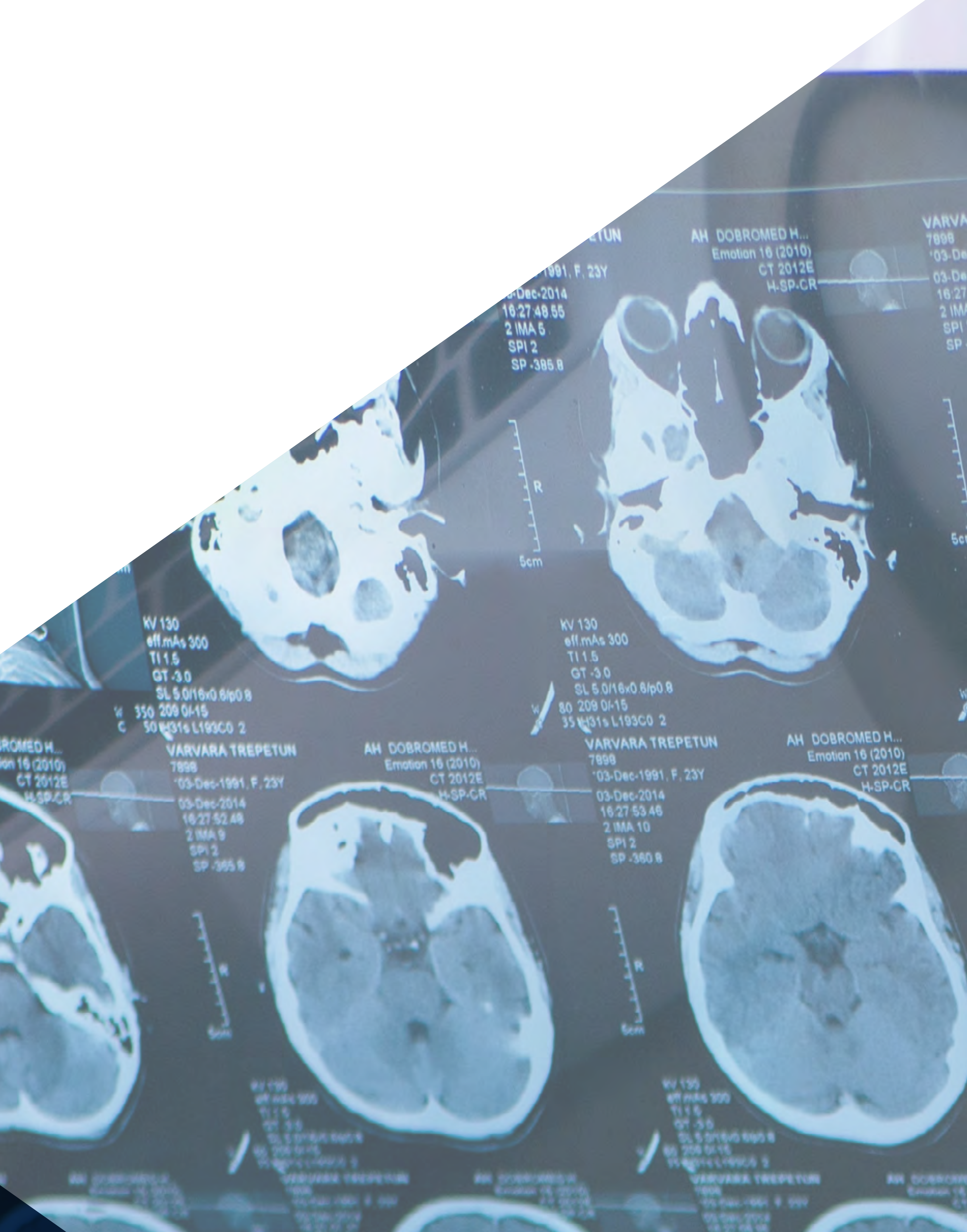
- Determine the radiological risks present in hospital radioactive facilities, as well as the specific magnitudes and units applied in these cases
- Establish the concepts applicable to the design of a radioactive facility, knowing the main specific parameters

You will analyze the physical basis of radiation dosimetry, with the objective of understanding how to measure personal and environmental dose"

03

Skills

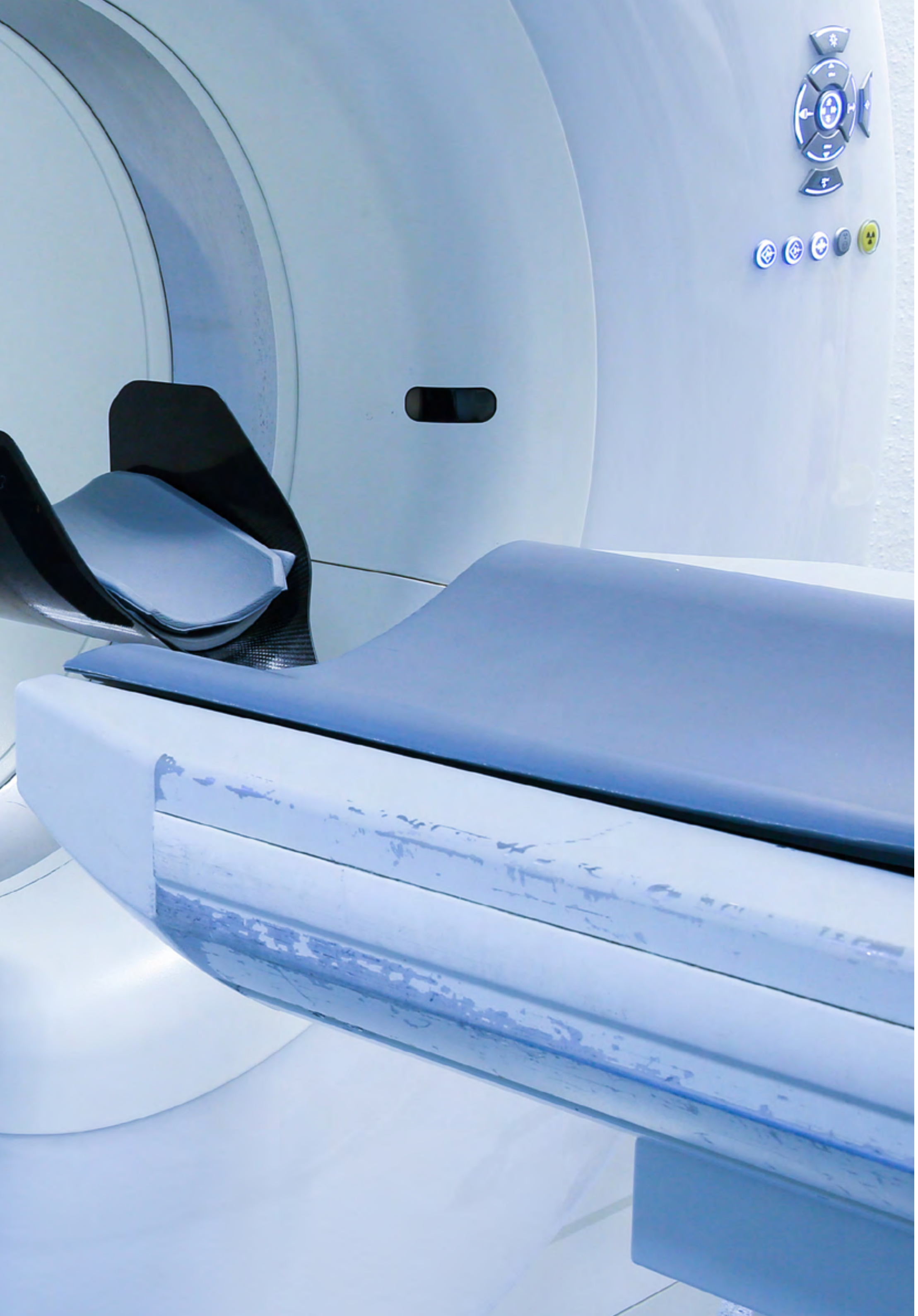
This program will provide graduates with a set of skills that will place them at the forefront of professional excellence. In this way, the interaction of ionizing radiation with matter, radiobiology, dosimetry and advanced radiotherapy techniques will be studied in depth. In addition, it will delve into diagnostic imaging tools, radiation protection in hospital environments and the ability to adapt to the latest technologies, including proton therapy and intraoperative radiotherapy. This Professional Master's Degree will equip health professionals with the ability to offer accurate diagnoses and effective treatments.



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

General Skills

- Develop the existing mathematical models and their differences
- Specify the equipment used in external radiotherapy treatments
- Develop the most relevant and advanced physical aspects of the proton therapy beam
- Establish radiation protection and patient safety practices
- Create strategies to optimize radiation distribution in the target tissue and to minimize the irradiation of surrounding healthy tissues
- Propose quality management protocols for Brachytherapy procedures
- Compile the instrumentation of a Nuclear Medicine Service
- Develop in depth knowledge of gamma cameras and PET
- Specify the main safety actions in the use of ionizing radiation
- Design and manage the structural shielding against existing radiation in hospitals



Specific Skills

- Perform quality control of an ionization chamber
- Set up simulation, localization and image-guided radiotherapy equipment
- Control photon beam and electron beam calibration procedures
- Master the tools to evaluate external radiotherapy planning
- Propose specific measures to minimize radiation exposure
- Develop source calibration techniques using well and air chambers
- Specify the procedures and planning for prostate Brachytherapy
- Establish the physical basis of gamma camera and PET performance
- Determine the quality controls between gamma cameras and PET
- Carry out radiological protection actions in hospital departments

"You will use external radiation therapy to kill tumor cells and spare surrounding healthy tissues. Enroll now!"

04
Course Management

The teaching team of this academic degree is composed of highly qualified professionals with vast experience in clinical practice and research in the field of Radiophysics. These experts will not only transmit cutting-edge theoretical knowledge, but will also share practical perspectives and real cases that will enrich the understanding of the graduates.
Their commitment goes beyond teaching, reflected in their encouragement of critical thinking and their invaluable guidance in innovative projects.

Learn with the best! The diversity of talents and knowledge of the faculty will create a dynamic and enriching learning environment"

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. 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

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

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), Spanish Society of Medical Physics (SEFM)

A unique, key, and decisive educational experience to boost your professional development"

05

Structure and Content

The structure of this program will cover a complete range of content. From fundamental modules, such as radiobiology, to clinical dosimetry and cutting-edge techniques, such as proton therapy and intraoperative radiotherapy, physicians will address the most relevant aspects. Therefore, they will acquire specialized skills in the administration of radiotherapeutic treatments, as well as the mastery of diagnostic imaging. This syllabus, backed by the most advanced technology and the support of an elite teaching staff, will place graduates at the pinnacle of the field of Radiophysics, preparing them to lead and transform modern medicine.

Thanks to this 100% online Professional Master's Degree, you will delve into the functions of state-of-the-art equipment, such as Mobile Linear Accelerators and Intraoperative Imaging Systems"

Module 1. Interaction of Ionizing Radiation with Matter

1.1. Radiation Ionizing-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. Charged Particle Equilibrium
   1.4.2. Bragg-Gray Cavity Theory
   1.4.3. Spencer-Attix Theory
   1.4.4. Absorbed Dose in Air
1.5. Magnitudes in Radiation Dosimetry
   1.5.1. Dosimetric Quantities
   1.5.2. Radiation Protection Quantities
   1.5.3. Radiation Weighting Factors
   1.5.4. Weighting Factors of Organs according to their 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 Setting
1.7. Dosimetry of Ionizing Radiation
    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. Calibration of Dosimeters
    1.8.3. Calibration at 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 the Measurement
    1.9.8. Quality Control of an Ionization Chamber
1.10. Uncertainty in Radiation Measurement
    1.10.1. Uncertainty in the Measurement
    1.10.2. Tolerance and Action Level
    1.10.3. Type A Uncertainty
    1.10.4. Type B Uncertainty

Module 2. Radiobiology

2.1. Interaction of Radiation with Organic Tissues
    2.1.1. Interaction of Radiation with Tissues
    2.1.2. Interaction of Radiation with Cells
    2.1.3. Physical-Chemical Response
2.2. Effects of Ionizing Radiation on DNA
    2.2.1. Structure of DNA
    2.2.2. Radiation-induced Damage
    2.2.3. Damage Repair
2.3. Effects of Radiation on Organic Tissues
    2.3.1. Effects on the Cell Cycle
    2.3.2. Irradiation Syndromes
    2.3.3. Aberrations and Mutations
2.4. Mathematical Models of Cell Survival
    2.4.1. Mathematical Models of Cell Survival
    2.4.2. Alpha-Beta Model
    2.4.3. Effect of Fractionation
2.5. Efficacy of Ionizing Radiations on Organic Tissues
    2.5.1. Relative Biological Efficacy
    2.5.2. Factors Altering Radiosensitivity
    2.5.3. LET and Oxygen Effect
2.6. Biological Aspects according to the Dose of Ionizing Radiations
    2.6.1. Radiobiology at Low Doses
    2.6.2. Radiobiology at High Doses
    2.6.3. Systemic Response to Radiation
2.7. Estimation of the Risk of Ionizing Radiation Exposure
    2.7.1. Stochastic and Random Effects
    2.7.2. Risk Estimation
    2.7.3. ICRP Dose Limits
2.8. Radiobiology in Medical Exposures in Radiotherapy
    2.8.1. Isoeffect
    2.8.2. Proliferation Effect
    2.8.3. Dose-Response

2.9. Radiobiology in Medical Exposures in Other Medical Exposures
 2.9.1. Brachytherapy
 2.9.2. Radiodiagnostics
 2.9.3. Nuclear Medicine
2.10. Statistical Models in Cell Survival
 2.10.1. Statistical Models
 2.10.2. Survival Analysis
 2.10.3. Epidemiological Studies

Module 3. External Radiotherapy. Physical Dosimetry

3.1. Linear Electron Accelerator. Equipment in External Radiotherapy
 3.1.1. Linear Electron Accelerator (LEA)
 3.1.2. External Radiotherapy Treatment Planner (TPS)
 3.1.3. Record Keeping and Verification System
 3.1.4. Special Techniques
 3.1.5. Hadrontherapy
3.2. Simulation and Localization Equipment in External Radiation Therapy
 3.2.1. Conventional Simulator
 3.2.2. Computed Tomography (CT) Simulation
 3.2.3. Other Image Modalities
3.3. Image-guided External Radiation Therapy Equipment
 3.3.1. Simulation equipment
 3.3.2. Image-guided Radiotherapy Equipment. CBCT
 3.3.3. Image-guided Radiotherapy Equipment. Planar Image
 3.3.4. Auxiliary Localization Systems
3.4. Photon Beams in Physical Dosimetry
 3.4.1. Measuring Equipment
 3.4.2. Calibration Protocols
 3.4.3. Calibration of Photon Beams
 3.4.4. Relative Dosimetry of Photon Beams
3.5. Electron Beams in Physical Dosimetry
 3.5.1. Measuring Equipment
 3.5.2. Calibration Protocols
 3.5.3. Calibration of Electron Beams
 3.5.4. Relative Dosimetry of Electron Beams
3.6. Implementation of External Radiotherapy Equipment
 3.6.1. Installation of External Radiotherapy Equipment
 3.6.2. Acceptance of External Radiotherapy Equipment
 3.6.3. Initial Reference Status (IRS)
 3.6.4. Clinical Use of External Radiotherapy Equipment
 3.6.5. Treatment Planning Systems
3.7. Quality Control of External Radiotherapy Equipment
 3.7.1. Quality Control of Linear Accelerators
 3.7.2. Quality Control in the IGRT Equipment
 3.7.3. Quality Control in Simulation Systems
 3.7.4. Special Techniques
3.8. Quality Control of Radiation Measuring Equipment
 3.8.1. Dosimetry
 3.8.2. Measuring Tools
 3.8.3. Mannequins Employed
3.9. Application of Risk Analysis Systems in External Radiation Therapy
 3.9.1. Risk Analysis Systems
 3.9.2. Error Reporting Systems
 3.9.3. Process Mapping
3.10. Quality Assurance Programming in Physical Dosimetry
 3.10.1. Responsibilities
 3.10.2. Requirements in External Radiotherapy
 3.10.3. Quality Assurance Programming Clinical and Physical Aspects
 3.10.4. Maintenance of Quality Control Program

Module 4. External Radiotherapy. Clinical Dosimetry

4.1. Clinical Dosimetry in External Radiotherapy
    4.1.1. Clinical Dosimetry in External Radiotherapy
    4.1.2. Treatment in External Radiotherapy
    4.1.3. Beam Modifying Elements
4.2. Stages of Clinical Dosimetry of External Radiotherapy
    4.2.1. Simulation Stage
    4.2.2. Treatment Planning
    4.2.3. Treatment Verification
    4.2.4. Linear Electron Accelerator Treatment
4.3. Treatment Planning Systems in External Radiotherapy
    4.3.1. Models in Planning Systems
    4.3.2. Calculating Algorithms
    4.3.3. Utilities of Planning Systems
    4.3.4. Imaging Tools for Planning Systems
4.4. Quality Control of Planning Systems in External Radiotherapy
    4.4.1. Quality Control of Planning Systems in External Radiotherapy
    4.4.2. Initial Reference State
    4.4.3. Periodic Controls
4.5. Manual Calculation of Monitor Units (MUs)
    4.5.1. Manual Control of MUs
    4.5.2. Intervening Factors in Dose Distribution
    4.5.3. Practical Example of Calculation of UMs
4.6. Conformal 3D Radiotherapy Treatments
    4.6.1. 3D Radiotherapy (RT3D)
    4.6.2. Photon Beam RT3D Treatments
    4.6.3. Electron Beam RT3D Treatments
4.7. Advanced Intensity Modulated Treatments
    4.7.1. Modulated Intensity Treatments
    4.7.2. Optimization
    4.7.3. Specific Quality Control

4.8. Evaluation of External Radiation Therapy Planning
- 4.8.1. Dose-volume Histogram
- 4.8.2. Conformation Index and Homogeneity Index
- 4.8.3. Clinical Impact of the Planning
- 4.8.4. Planning Errors

4.9 Advanced Special Techniques in External Radiotherapy
- 4.9.1. Radiosurgery and Extracranial Stereotactic Radiotherapy
- 4.9.2. Total Body Irradiation
- 4.9.3. Total Body Surface Irradiation
- 4.9.4. Other Technologies in External Radiotherapy

4.10. Verification of Treatment Plans in External Radiotherapy
- 4.10.1. Verification of Treatment Plans in External Radiotherapy
- 4.10.2. Treatment Verification Systems
- 4.10.3. Treatment Verification Metrics

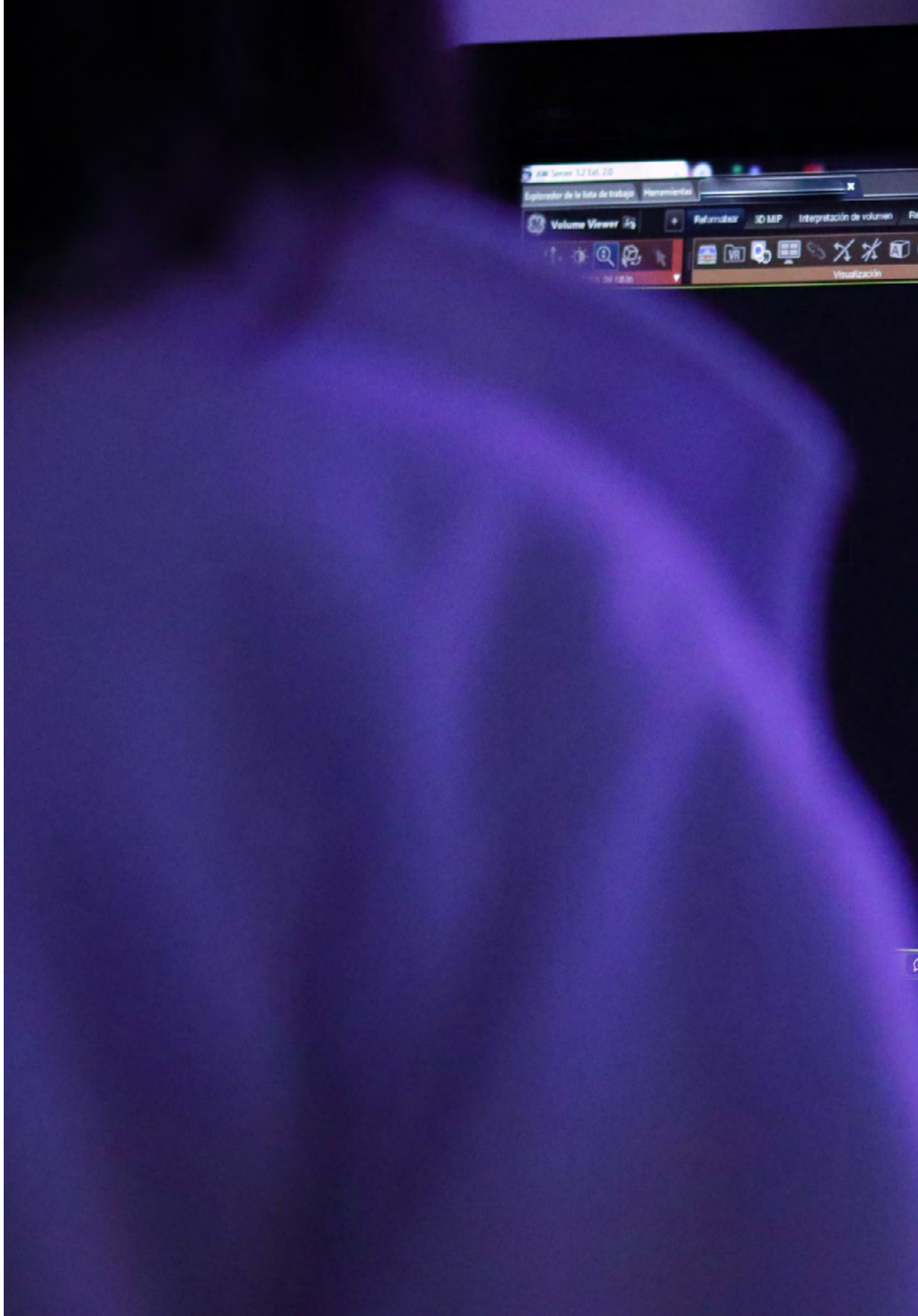
Module 5. Advanced Radiotherapy Method. Proton Therapy

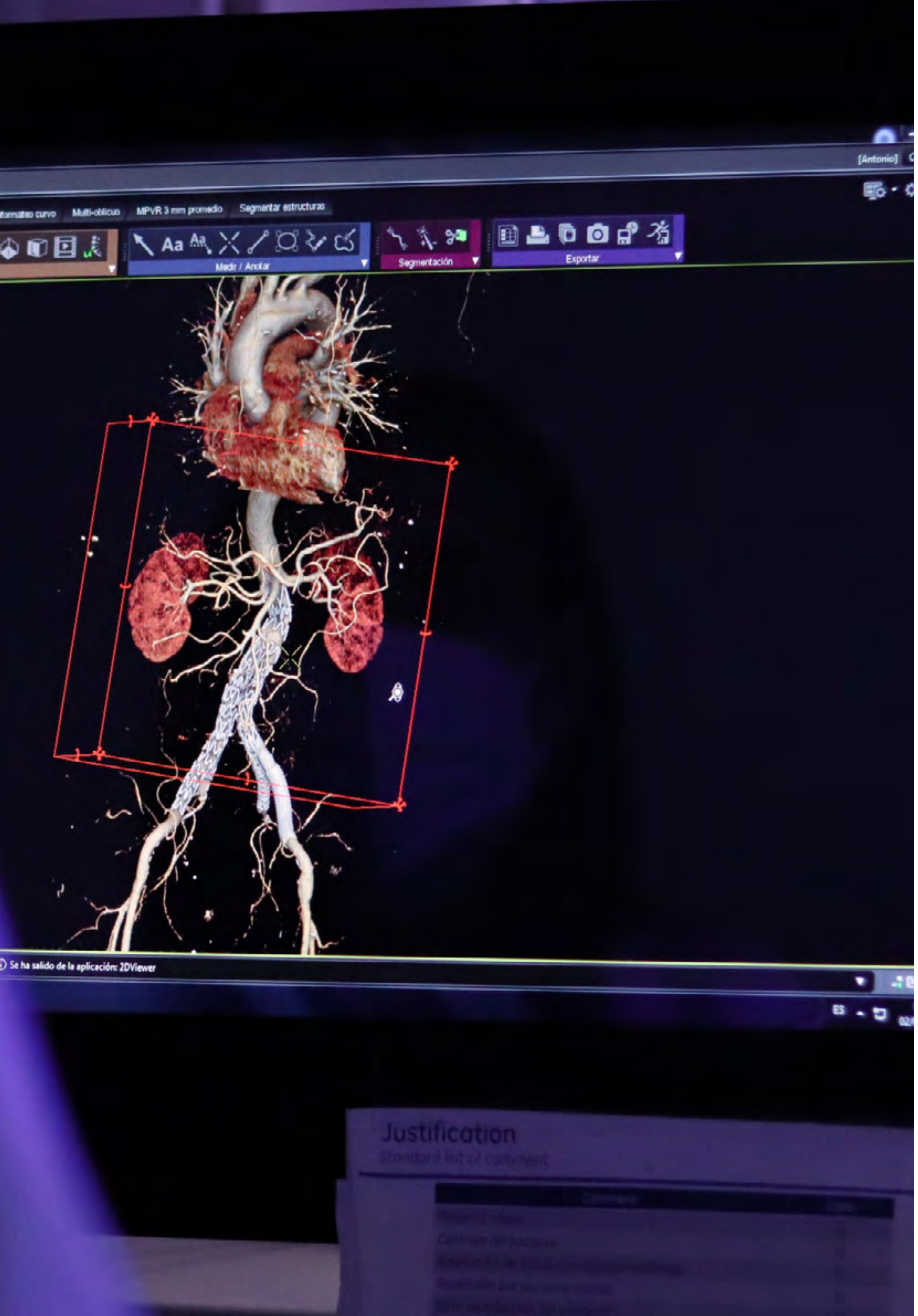
5.1. Proton Therapy Radiotherapy with Protons
- 5.1.1. Interaction of Protons with Matter
- 5.1.2. Clinical Aspects of Proton Therapy
- 5.1.3. Physical and Radiobiological Basis of Proton Therapy

5.2. Equipment in Proton Therapy
- 5.2.1. Facilities
- 5.2.2. Components in Proton Therapy Systems
- 5.2.3. Physical and Radiobiological Basis of Proton Therapy

5.3. Proton Beam
- 5.3.1. Parameters
- 5.3.2. Clinical Implications
- 5.3.3. Application in Oncological Treatments

5.4. Physical Dosimetry in Proton Therapy
- 5.4.1. Absolute Dosimetry Measurements
- 5.4.2. Beam Parameters
- 5.4.3. Materials in Physical Dosimetry





5.5. Clinical Dosimetry in Proton Therapy
- 5.5.1. Application of Clinical Dosimetry in Proton Therapy
- 5.5.2. Planning and Calculation Algorithms
- 5.5.3. Imaging Systems

5.6. Radiological Protection in Proton Therapy Procedures
- 5.6.1. Design of an Installation
- 5.6.2. Neutron Production and Activation
- 5.6.3. Activation

5.7. Proton Therapy Treatments
- 5.7.1. Image-Guided Treatment
- 5.7.2. In Vivo Treatment Verification
- 5.7.3. BOLUS Usage

5.8. Biological Effects of Proton Therapy
- 5.8.1. Physical Aspects
- 5.8.2. Radiobiology
- 5.8.3. Dosimetric Implications

5.9. Measuring Equipment in Proton Therapy
- 5.9.1. Dosimetric Equipment
- 5.9.2. Radiation Protection Equipment
- 5.9.3. Personal Dosimetry

5.10. Uncertainties in Proton Therapy
- 5.10.1. Uncertainties Associated with Physical Concepts
- 5.10.2. Uncertainties Associated with the Therapeutic Process
- 5.10.3. Advances in Proton Therapy

Module 6. Advanced Radiotherapy Method. Intraoperative Radiotherapy

6.1. Intraoperative Radiotherapy
- 6.1.1. Intraoperative Radiotherapy
- 6.1.2. Current Approach to Intraoperative Radiotherapy
- 6.1.3. Intraoperative Radiotherapy versus Conventional Radiotherapy

6.2. Technology in Intraoperative Radiotherapy
- 6.2.1. Mobile Linear Accelerators in Intraoperative Radiotherapy
- 6.2.2. Intraoperative Imaging Systems
- 6.2.3. Quality Control and Maintenance of Equipment

6.3. Treatment Planning Systems in Intraoperative Radiotherapy
- 6.3.1. Dose Calculation Methods
- 6.3.2. Volumetry and Delineation of Organs at Risk
- 6.3.3. Dose Optimization and Fractionation

6.4. Clinical Indications and Patient Selection for Intraoperative Radiotherapy
- 6.4.1. Types of Cancer Treated with Intraoperative Radiotherapy
- 6.4.2. Assessment of Patient Suitability
- 6.4.3. Clinical Studies and Discussion

6.5. Surgical Procedures in Intraoperative Radiotherapy
- 6.5.1. Surgical Preparation and Logistics
- 6.5.2. Radiation Administration Techniques During Surgery
- 6.5.3. Postoperative Follow-up and Patient Care

6.6. Calculation and Administration of Radiation Dose for Intraoperative Radiotherapy
- 6.6.1. Formulas and Dosis Calculation Algorithms
- 6.6.2. Dose Correction and Adjustment Factors
- 6.6.3. Real-time Monitoring during Surgery

6.7. Radiation Protection and Safety in Intraoperative Radiotherapy
- 6.7.1. International Radiation Protection Standards and Regulations
- 6.7.2. Safety Measures for the Medical Staff and the Patient
- 6.7.3. Risk Mitigation Strategies

6.8. Interdisciplinary Collaboration in Intraoperative Radiotherapy
- 6.8.1. Role of the Multidisciplinary Team in Intraoperative Radiotherapy
- 6.8.2. Communication between Radiation Therapists, Surgeons and Oncologists
- 6.8.3. Practical Examples of Interdisciplinary Collaboration

6.9. Flash Technique. Latest Trend in Intraoperative Radiotherapy
- 6.9.1. Research and Development in Intraoperative Radiotherapy
- 6.9.2. New Technologies and Emerging Therapies in Intraoperative Radiotherapy
- 6.9.3. Implications for Future Clinical Practice

6.10. Ethics and Social Aspects in Intraoperative Radiotherapy
- 6.10.1. Ethical Considerations in Clinical Decision-Making
- 6.10.2. Access to Intraoperative Radiotherapy and Equity of Care
- 6.10.3. Communication with Patients and Family in Complex Situations

Module 7. Brachytherapy in the Field of Radiotherapy

7.1. Brachytherapy
- 7.1.1. Physical Principles of Brachytherapy
- 7.1.2. Biological Principles and Radiobiology Applied to Brachytherapy
- 7.1.3. Brachytherapy and External Radiotherapy. Differences

7.2. Radiation Sources in Brachytherapy
- 7.2.1. Radiation Sources Used in Brachytherapy
- 7.2.2. Radiation Emission of the Sources Used
- 7.2.3. Calibration of Sources
- 7.2.4. Safety in the Handling and Storage of Brachytherapy Sources

7.3. Dose Planning in Brachytherapy
- 7.3.1. Techniques of Dose Planning in Brachytherapy
- 7.3.2. Optimization of the Dose Distribution in the Target Tissue
- 7.3.3. Application of the Monte Carlo Method
- 7.3.4. Specific Considerations to Minimize Irradiation of Healthy Tissues
- 7.3.5. TG 43 Formalism

7.4. Administration Techniques in Brachytherapy
- 7.4.1. High Dose Rate Brachytherapy (HDR) versus Low Dose Rate Brachytherapy (LDR)
- 7.4.2. Clinical Procedures and Treatment Logistics
- 7.4.3. Management of Devices and Catheters Used in the Administration of Brachytherapy

7.5. Clinical Indications for Brachytherapy
- 7.5.1. Application of Brachytherapy in the Treatment of Prostate cancer
- 7.5.2. Brachytherapy in Cervical Cancer: Technique and Results
- 7.5.3. Brachytherapy in Breast Cancer: Clinical Considerations and Results

7.6. Brachytherapy Quality Management
- 7.6.1. Specific Quality Management Protocols for Brachytherapy
- 7.6.2. Quality Control of Equipment and Treatment Systems
- 7.6.3. Audit and Compliance with Regulatory Standards

7.7. Clinical Results in Brachytherapy
- 7.7.1. Review of Clinical Studies and Outcomes in the Treatment of Specific Cancers
- 7.7.2. Brachytherapy Efficacy and Toxicity Assessment
- 7.7.3. Clinical Cases and Discussion of Results

7.8. Ethics and International Regulatory Aspects in Brachytherapy
- 7.8.1. Ethical Issues in Shared Decision-Making with Patients
- 7.8.2. Compliance with International Radiation Safety Standards and Regulations
- 7.8.3. International Liability and Legal Aspects in Brachytherapy Practice

7.9. Technological Development in Brachytherapy
- 7.9.1. Technological Innovations in the Field of Brachytherapy
- 7.9.2. Research and Development of New Techniques and Devices in Brachytherapy
- 7.9.3. Interdisciplinary Collaboration in Brachytherapy Research Projects

7.10. Practical Application and Simulations in Brachytherapy
- 7.10.1. Clinical Simulation for Brachytherapy
- 7.10.2. Resolution of Practical Situations and Technical Challenges
- 7.10.3. Evaluation of Treatment Plans and Discussion of Results

Module 8. Advanced Diagnostic Imaging

8.1. Advanced Physics in X-Ray Generation
- 8.1.1. X-ray Tubes
- 8.1.2. Radiation Spectra Used in Radiodiagnosis
- 8.1.3. Radiological Technique

8.2. Imaging in Radiology
- 8.2.1. Digital Image Recording Systems
- 8.2.2. Dynamic Imaging
- 8.2.3. Radiodiagnostic Equipment

8.3. Quality Control in Radiodiagnostics
- 8.3.1. Quality Assurance Program in Radiodiagnosis
- 8.3.2. Quality Protocols in Radiodiagnostics
- 8.3.3. General Quality Control Checks

8.4. Patient Dose Estimation in X-Ray Installations
- 8.4.1. Patient Dose Estimation in X-Ray Installations
- 8.4.2. Patient Dosimetry
- 8.4.3. Diagnostic Dose Reference Levels

8.5. General Radiology Equipment
- 8.5.1. General Radiology Equipment
- 8.5.2. Specific Quality Control Tests
- 8.5.3. Doses to Patients in General Radiology

8.6. Mammography Equipment
- 8.6.1. Mammography Equipment
- 8.6.2. Specific Quality Control Tests
- 8.6.3. Dose to Patients in Mammography

8.7. Fluoroscopy Equipment. Vascular and Interventional Radiology
- 8.7.1. Fluoroscopy Equipment
- 8.7.2. Specific Quality Control Tests
- 8.7.3. Dose to Patients in Interventions

8.8. Computed Tomography Equipment
- 8.8.1. Computed Tomography Equipment
- 8.8.2. Specific Quality Control Tests
- 8.8.3. Dose to Patients in CT

8.9. Other Radiodiagnostics Equipment
- 8.9.1. Other Radiodiagnostics Equipment
- 8.9.2. Specific Quality Control Tests
- 8.9.3. Non-ionizing Radiation Equipment

8.10. Radiological Image Visualization Systems
- 8.10.1. Digital Image Processing
- 8.10.2. Calibration of Display Systems
- 8.10.3. Quality Control of Visualization Systems

Module 9. Nuclear Medicine

9.1. Radionuclides used in Nuclear Medicine
- 9.1.1. Radionuclides
- 9.1.2. Typical Diagnostic Radionuclides
- 9.1.3. Typical Therapy Radionuclides

9.2. Typical Radionuclides in Therapy
- 9.2.1. Obtaining Artificial Radionuclides
- 9.2.2. Cyclotron
- 9.2.3. Generators

9.3. Instrumentation in Nuclear Medicine
- 9.3.1. Activimeters. Calibration of Activimeters
- 9.3.2. Intraoperative Probes
- 9.3.3. Gamma Camera and SPECT
- 9.3.4. PET

9.4. Quality Assurance Program in Nuclear Medicine
- 9.4.1. Quality Assurance in Nuclear Medicine
- 9.4.2. Acceptance, Reference and Constancy Tests
- 9.4.3. Good Practice Routine

9.5. Nuclear Medicine Equipment: Gamma Cameras
- 9.5.1. Image Formation
- 9.5.2. Image Acquisition Modes
- 9.5.3. Standard Patient Protocol

9.6. Nuclear Medicine Equipment: SPECT
- 9.6.1. Tomographic Reconstruction
- 9.6.2. Synogram
- 9.6.3. Reconstruction Corrections

9.7. Nuclear Medicine Equipment: PET
- 9.7.1. Physical Basis
- 9.7.2. Detector Material
- 9.7.3. 2D and 3D Acquisition. Sensitivity
- 9.7.4. Time of Flight

9.8. Image Reconstruction Corrections in Nuclear Medicine
- 9.8.1. Attenuation Correction
- 9.8.2. Dead Time Correction
- 9.8.3. Random Event Correction
- 9.8.4. Scattered Photon Correction
- 9.8.5. Standardization
- 9.8.6. Image Reconstruction

9.9. Quality Control of Nuclear Medicine Equipment
- 9.9.1. International Guidelines and Protocols
- 9.9.2. Planar Gamma Cameras
- 9.9.3. Tomographic Gamma Cameras
- 9.9.4. PET

9.10. Dosimetry in Nuclear Medicine Patients
- 9.10.1. MIRD Formalism
- 9.10.2. Uncertainty Estimation
- 9.10.3. Erroneous Administration of Radiopharmaceuticals

Module 10. Radiation Protection in Hospital Radioactive Facilities

10.1. Radiation Protection in Hospitals
- 10.1.1. Radiation Protection in Hospitals
- 10.1.2. Radiological Protection Magnitudes and Specialized Radiation Protection Units
- 10.1.3. Risks in the Hospital Area

10.2. International Radiation Protection Standards
- 10.2.1. International Legal Framework and Authorizations
- 10.2.2. International Regulations on Health Protection against Ionizing Radiation
- 10.2.3. International Regulations on Radiological Protection of the Patient
- 10.2.4. International Regulations on the Specialty of Hospital Radiophysics
- 10.2.5. Other International Regulations

10.3. Radiation Protection in Hospital Radioactive Facilities
- 10.3.1. Nuclear Medicine
- 10.3.2. Radiodiagnostics
- 10.3.3. Radiotherapy Oncology

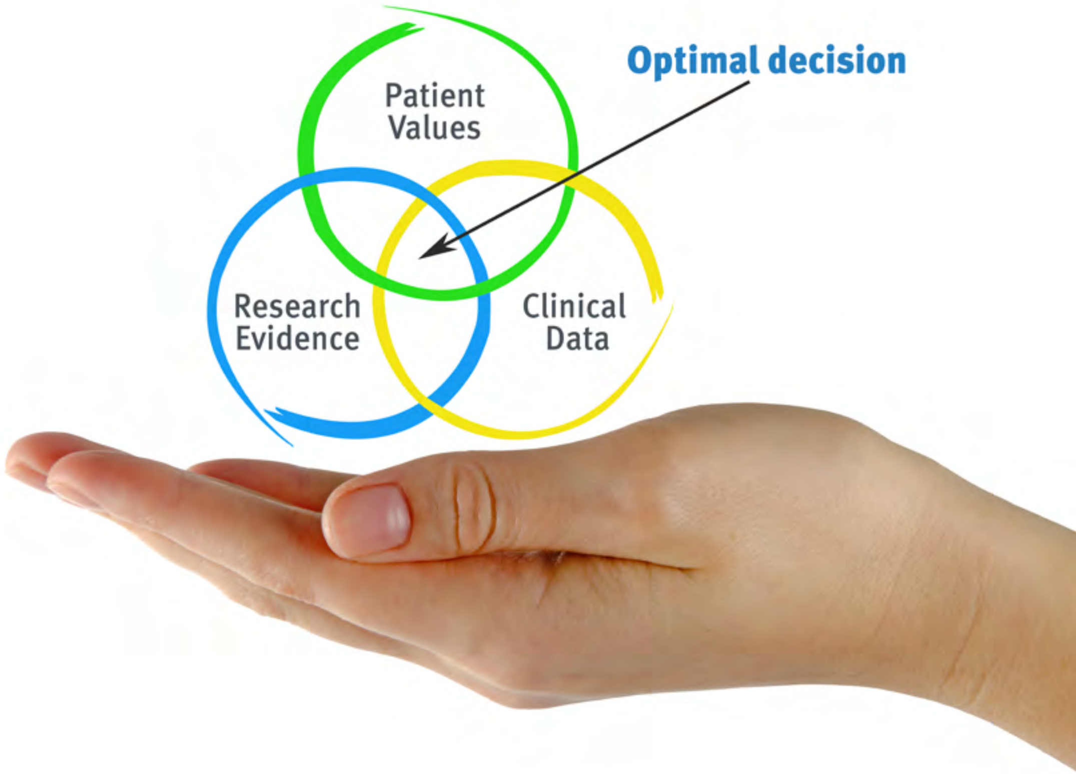
06
Methodology

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:

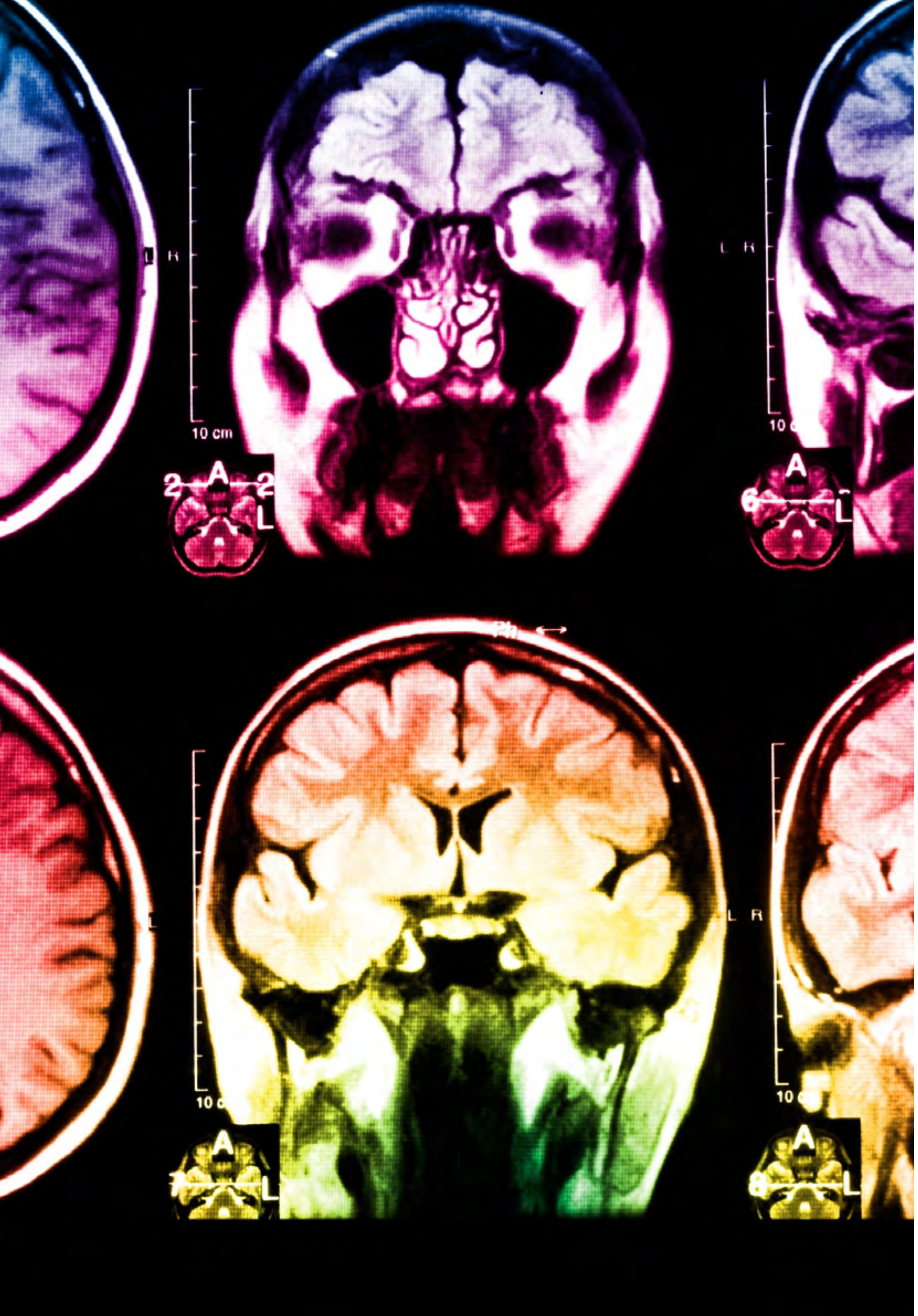
1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that evaluate real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better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

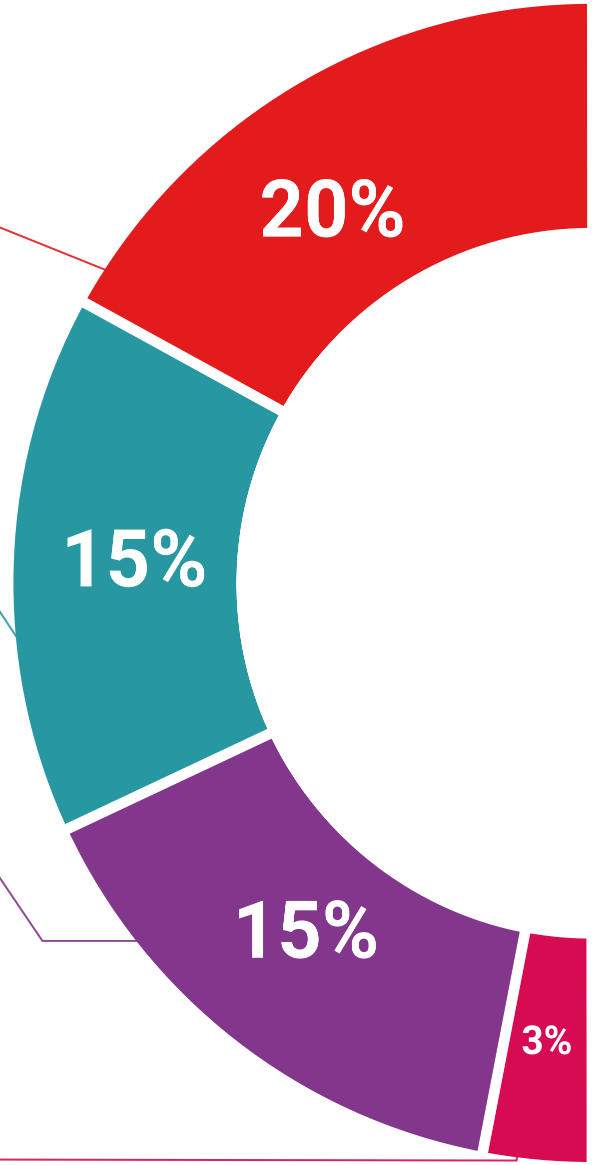
With this methodology, more than 250,000 physicians have been trained with unprecedented success in all clinical specialties regardless of surgical load. Our pedagogical methodology is developed in a highly competitive environment, with a university student body with a strong socioeconomic profile and 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.

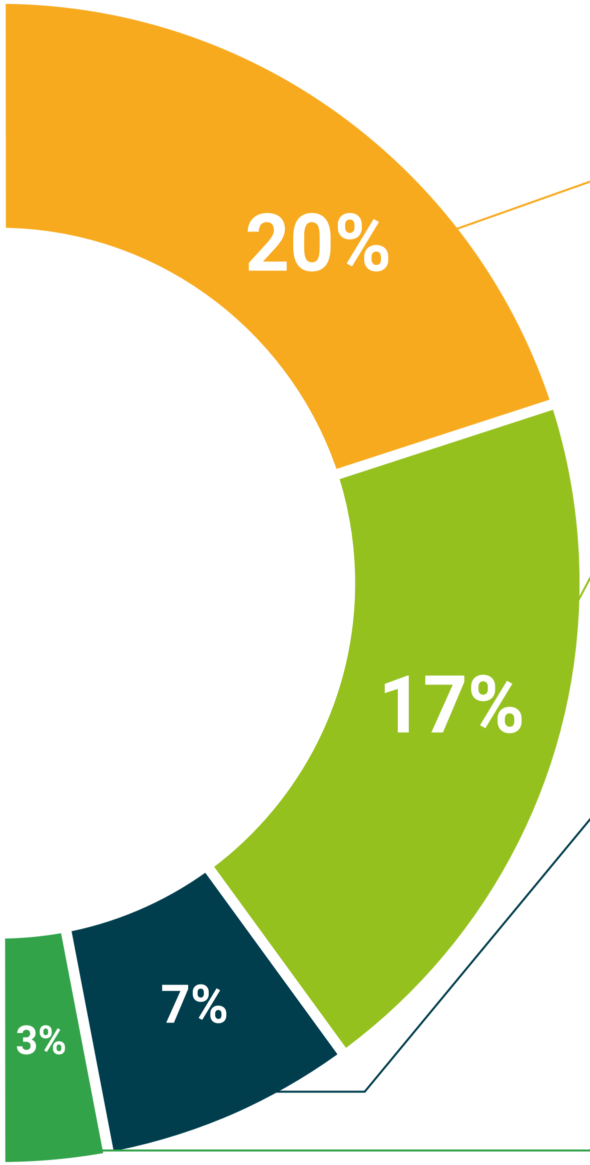
Interactive Summaries

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.

07

Certificate

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

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

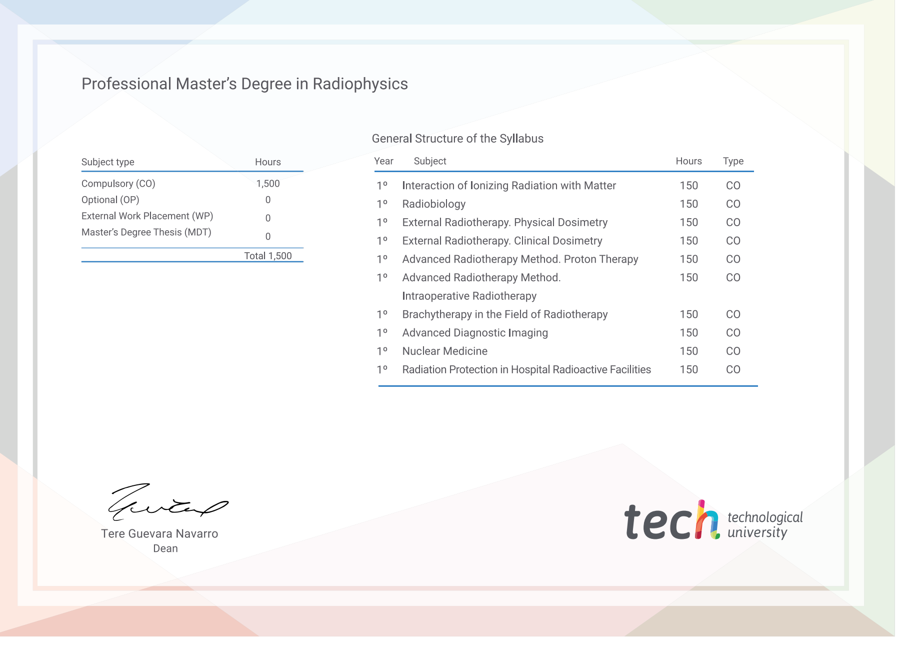
This **Professional Master's Degree in Radiophysics** contains the most complete and up-to-date scientific program on the market.

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

The certificate issued by **TECH Technological University** will express the qualification obtained in the Professional Master's Degree, and will meet the requirements commonly demanded by labor exchanges, competitive examinations, and professional career from assessment committees.

Title: **Professional Master's Degree in Radiophysics**

Official Nº of Hours: **1,500 h.**



Professional Master's Degree in Radiophysics

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

General Structure of the Syllabus

Year	Subject	Hours	Type
1º	Interaction of Ionizing Radiation with Matter	150	CO
1º	Radiobiology	150	CO
1º	External Radiotherapy. Physical Dosimetry	150	CO
1º	External Radiotherapy. Clinical Dosimetry	150	CO
1º	Advanced Radiotherapy Method. Proton Therapy	150	CO
1º	Advanced Radiotherapy Method. Intraoperative Radiotherapy	150	CO
1º	Brachytherapy in the Field of Radiotherapy	150	CO
1º	Advanced Diagnostic Imaging	150	CO
1º	Nuclear Medicine	150	CO
1º	Radiation Protection in Hospital Radioactive Facilities	150	CO

*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.

Professional Master's Degree
Radiophysics

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

Professional Master's Degree

Radiophysics

tech technological university