Postgraduate Certificate
Medical Physics

tech global university

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Postgraduate Certificate
Medical Physics

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Global University**
- Accreditation: **6 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/engineering/postgraduate-certificate/medical-physics**

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01

Introduction

The field of Medicine is evolving rapidly, thanks to other sciences such as Physics and Chemistry, as well as the implementation of new technologies. This has enabled engineers to find new solutions for the maintenance of medical equipment and systems, such as medical imaging devices, linear accelerators for radiation therapy, and dosimetry equipment. A prime example is the field of Radiotherapy, where innovative tools like Computed Tomography are used to effectively and safely plan and administer doses. In this context, TECH Global University offers a cutting-edge program that delves into the latest innovations in this area. All through a convenient 100% online format.

Thanks to this 100% online Postgraduate Certificate, you will optimize Radiotherapy and Nuclear Medicine treatments while ensuring patient safety"

Biomedical Imaging is a crucial element for the early diagnosis of multiple pathologies and for monitoring the effectiveness of treatments. For example, in Oncology, imaging can show changes in the size or appearance of tumors, reflecting the response to the applied therapies. In this context, healthcare professionals need to stay at the forefront of the latest advancements in this field. One of the latest trends is Computed Tomography, which is used to determine the extent of a disease and monitor treatments.

Therefore, TECH Global University develops a pioneering program in Medical Physics. The academic curriculum will thoroughly analyze natural and artificial radiation sources, addressing factors such as charged particle accelerators. The syllabus will also delve into Reconstruction Algorithms to generate medical images and use them to detect anomalies early. In addition, the teaching materials will focus on handling Biomedical Imaging to evaluate treatment effectiveness and make adjustments to the treatment strategy as needed. Furthermore, the program will address the importance of the Fourier Transform for processing medical images.

It is important to note that this university program stands out for its 100% online methodology. This format will provide specialists with the flexibility needed to adapt to their professional schedules. Additionally, TECH Global University employs the Relearning methodology, based on the repetition of key concepts, to consolidate knowledge and facilitate effective learning. As such, the combination of accessibility and innovative pedagogical approach will ensure that professionals acquire practical skills. All experts need to access the Virtual Campus is an electronic device with internet access, whether using their own mobile phone, computer, or tablet.

This **Postgraduate Certificate in Medical Physics** contains the most complete and up-to-date program on the market. The most important features include:

- Practical case studies are presented by experts in Physics
- The graphic, schematic and eminently practical contents with which it is conceived gather scientific and practical information on those disciplines that are indispensable 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

Acquire the most advanced techniques for Biomedical Image Reconstruction at the world's best digital university, according to Forbes"

You will explore the modules of this program through the revolutionary Relearning methodology, quickly and flexibly incorporating its most complex concepts"

You will delve into Reconstruction Algorithms to generate detailed medical images that contribute to the precise planning of treatments.

You will master the Planar Gamma Scintigraphy technique to visualize the three-dimensional distribution of radionuclides within the human body.

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.

Its multimedia content, developed with the latest educational technology, will allow the professional a situated and contextual learning, that is, a simulated environment that will provide an immersive learning programmed to prepare for real situations.

The design of this program focuses on Problem-Based Learning, where the professional will need to address various practical situations presented throughout the academic program. For this purpose, students will be assisted by an innovative interactive video system created by renowned experts.

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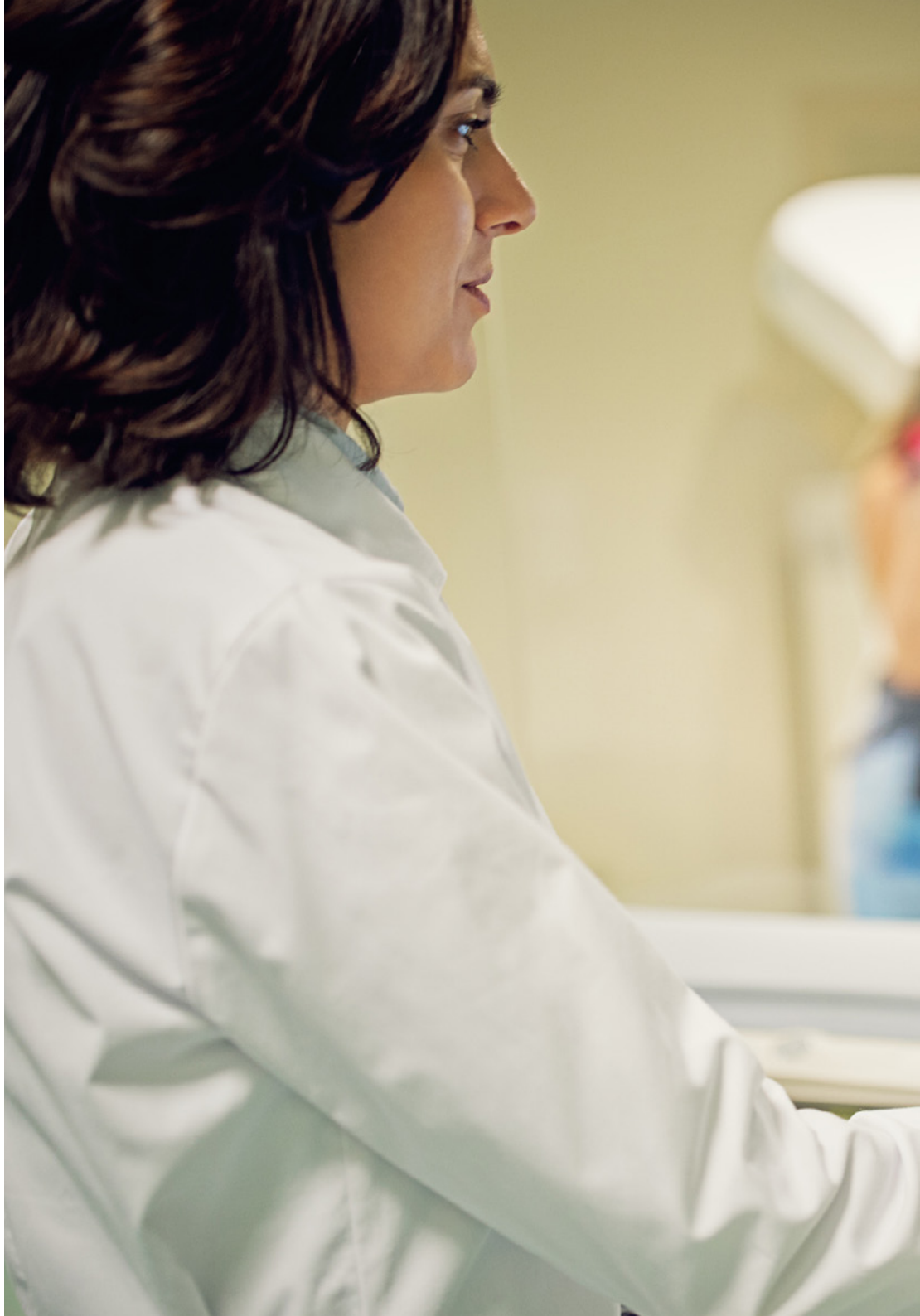
Objectives

Thanks to this Postgraduate Certificate, engineers will gain a solid understanding of the fundamental physical principles applied in the field of Medicine (such as mechanics or nuclear physics). In this context, professionals will be at the forefront of the latest trends in medical imaging in Radiology. They will work with innovative equipment such as Computed Tomography and Magnetic Resonance Imaging. Additionally, they will become familiar with the principles of radiological and dosimetric safety, as well as the regulations governing the use of ionizing radiation in medical settings.

You will develop skills to optimize the quality of medical images, ensuring precise and clear visualization of anatomical structures"

General Objectives

- Be able to explain behaviors using the basic equations of fluid dynamics
- Understand the four principles of thermodynamics and apply them to the study of thermodynamic systems
- Apply analysis, synthesis, and critical reasoning processes
- Know the key principles underlying Medical Physics
- Understand the concepts of 3D and 4D segmentation and processing
- Stay updated on advancements in remote sensing and image processing



Specific Objectives

- Study the concepts of metrology and dosimetry for ionizing radiation
- Understand the physical principles of diagnostic imaging
- Identify the physical principles and practical applications of nuclear medicine
- Get to know the physical principles behind radiation therapy

Carry out calibration processes for medical equipment to ensure precise and safe operation"

03

Structure and Content

Through this university program, engineers will gain a comprehensive understanding of the underlying physical principles in emerging technologies. To achieve this, the academic curriculum will delve into the interaction between radiation and matter. In line with this, the program will equip students with the most advanced techniques for obtaining biomedical images, applying improvements through histogram modifications. Additionally, the syllabus will explore the Monte Carlo Simulation technique, allowing graduates to optimize treatment plans to maximize the dose delivered to the tumor while minimizing the dose to surrounding healthy tissues.

You will acquire the most sophisticated techniques to optimize the quality of medical images, minimizing radiation exposure and maximizing the diagnostic information obtained"

Module 1. Medical Physics

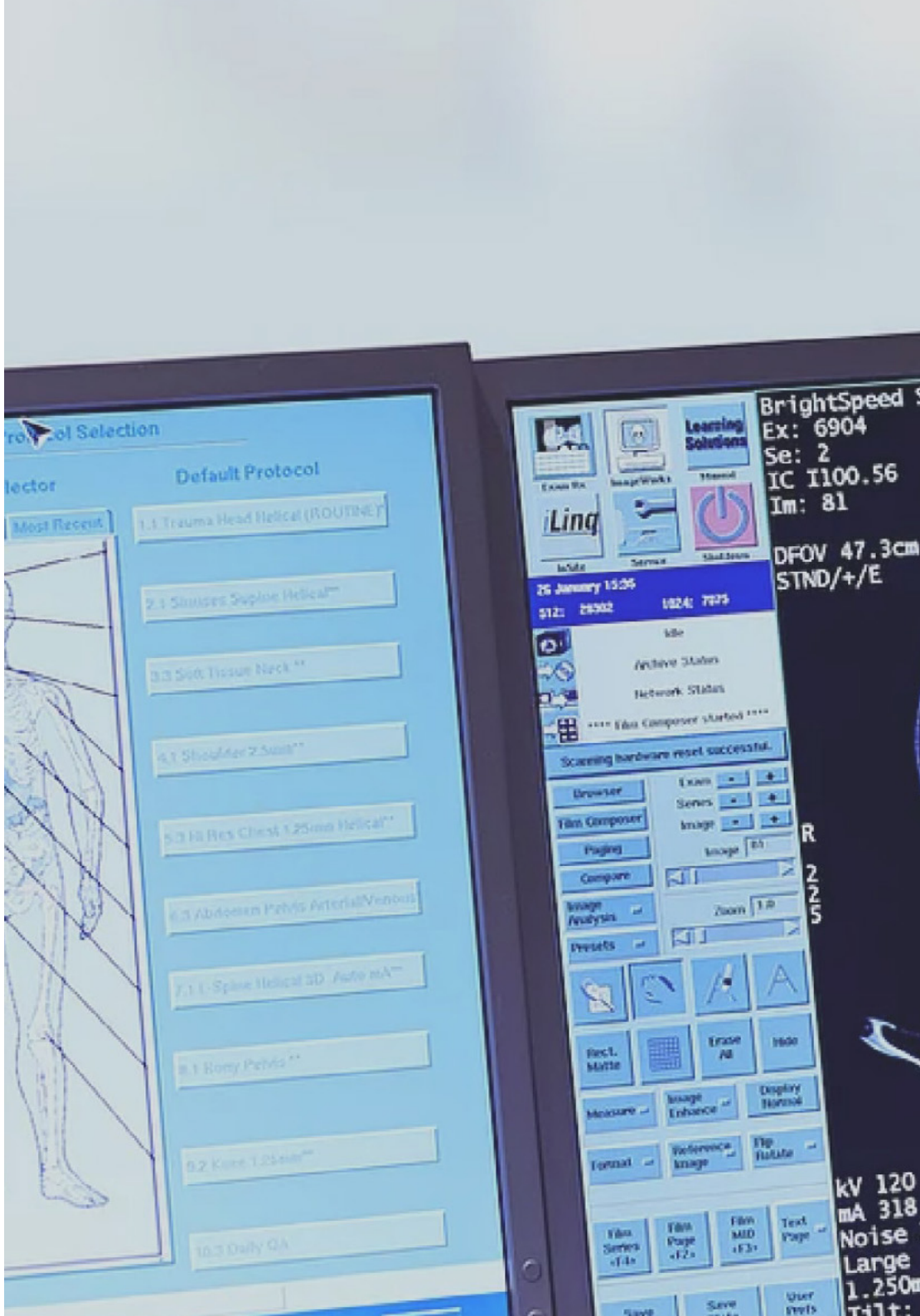
1.1. Natural and Artificial Radiation Sources
- 1.1.1. Alpha, Beta and Gamma Emitting Nuclei
- 1.1.2. Nuclear Reactions
- 1.1.3. Neutron Sources
- 1.1.4. Charged Particle Accelerators
- 1.1.5. X-Ray Generators

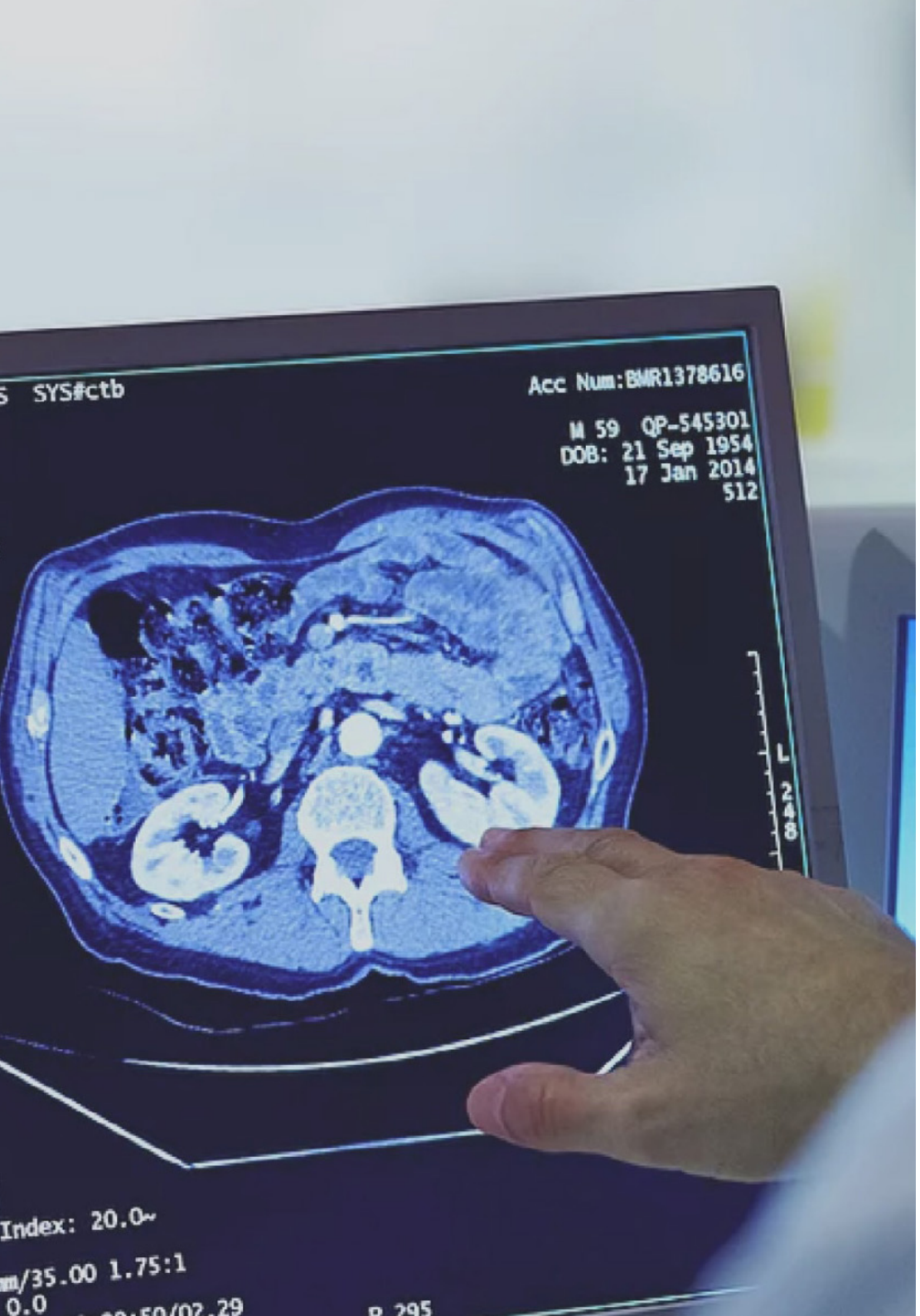
1.2. Radiation-Matter Interaction
- 1.2.1. Photon Interactions (Rayleigh and Compton Scattering, Photoelectric Effect and Electron-Positron Pair Creation)
- 1.2.2. Electron-Positron Interactions (Elastic and Inelastic Collisions, Bremsstrahlung Radiation Emission, and Positron Annihilation)
- 1.2.3. Ion Interactions
- 1.2.4. Neutron Interactions

1.3. Monte Carlo Simulation of Radiation Transport
- 1.3.1. Pseudo-Random Number Generation
- 1.3.2. Drawing Techniques
- 1.3.3. Radiation Transport Simulation
- 1.3.4. Practical Examples

1.4. Dosimetry
- 1.4.1. Dosimetric Quantities and Units (ICRU)
- 1.4.2. External Exposure
- 1.4.3. Radionuclides Incorporated in the Body
- 1.4.4. Radiation-Matter Interaction
- 1.4.5. Radiological Protection
- 1.4.6. Permitted Limits for the Public and Professionals

1.5. Radiobiology and Radiotherapy
- 1.5.1. Radiobiology
- 1.5.2. External Radiotherapy with Photons and Electrons
- 1.5.3. Brachytherapy
- 1.5.4. Advanced Treatment Methods (Ions and Neutrons)
- 1.5.5. Planning





1.6. Biomedical Imaging
- 1.6.1. Biomedical Imaging Techniques
- 1.6.2. Image Enhancement through Histogram Modification
- 1.6.3. Fourier Transform
- 1.6.4. Filtering
- 1.6.5. Restoration

1.7. Nuclear Medicine
- 1.7.1. Tracers
- 1.7.2. Detection Equipment
- 1.7.3. Gamma Camera
- 1.7.4. Planar Scintigraphy
- 1.7.5. SPECT
- 1.7.6. PET (Polyethylene Terephthalate)
- 1.7.7. Small Animal Equipment

1.8. Reconstruction Algorithms
- 1.8.1. Radon Transform
- 1.8.2. Central Slice Theorem
- 1.8.3. Filtered Back Projection Algorithm
- 1.8.4. Noise Filtering
- 1.8.5. Iterative Reconstruction Algorithms
- 1.8.6. Algebraic Algorithm (ART)
- 1.8.7. Maximum Likelihood Estimation Algorithm (MLE)
- 1.8.8. Ordered Subsets (OSEM)

1.9. Biomedical Image Reconstruction
- 1.9.1. SPECT Reconstruction
- 1.9.2. Degrading Effects Associated with Photon Attenuation, Scattering, System Response, and Noise.
- 1.9.3. Compensation in Filtered Back Projection Algorithm
- 1.9.4. Compensation in Iterative Methods

1.10. Radiology and Nuclear Magnetic Resonance (NMR)
- 1.10.1. Radiology Imaging Techniques: X-ray and CT
- 1.10.2. Introduction to NMR
- 1.10.3. NMR Imaging
- 1.10.4. NMR Spectroscopy
- 1.10.5. Quality Control

04

Study Methodology

TECH is the world's first university to combine the **case study** methodology with **Relearning**, a 100% online learning system based on guided repetition.

This disruptive pedagogical strategy has been conceived to offer professionals the opportunity to update their knowledge and develop their skills in an intensive and rigorous way. A learning model that places students at the center of the educational process giving them the leading role, adapting to their needs and leaving aside more conventional methodologies.

TECH will prepare you to face new challenges in uncertain environments and achieve success in your career"

The student: the priority of all TECH programs

In TECH's study methodology, the student is the main protagonist.
The teaching tools of each program have been selected taking into account the demands of time, availability and academic rigor that, today, not only students demand but also the most competitive positions in the market.

With TECH's asynchronous educational model, it is students who choose the time they dedicate to study, how they decide to establish their routines, and all this from the comfort of the electronic device of their choice. The student will not have to participate in live classes, which in many cases they will not be able to attend. The learning activities will be done when it is convenient for them. They can always decide when and from where they want to study.

"At TECH you will NOT have live classes (which you might not be able to attend)"

The most comprehensive study plans at the international level

TECH is distinguished by offering the most complete academic itineraries on the university scene. This comprehensiveness is achieved through the creation of syllabi that not only cover the essential knowledge, but also the most recent innovations in each area.

By being constantly up to date, these programs allow students to keep up with market changes and acquire the skills most valued by employers. In this way, those who complete their studies at TECH receive a comprehensive education that provides them with a notable competitive advantage to further their careers.

And what's more, they will be able to do so from any device, pc, tablet or smartphone.

> *TECH's model is asynchronous, so it allows you to study with your pc, tablet or your smartphone wherever you want, whenever you want and for as long as you want"*

Case Studies and Case Method

The case method has been the learning system most used by the world's best business schools. Developed in 1912 so that law students would not only learn the law based on theoretical content, its function was also to present them with real complex situations. In this way, they could make informed decisions and value judgments about how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

With this teaching model, it is students themselves who build their professional competence through strategies such as Learning by Doing or Design Thinking, used by other renowned institutions such as Yale or Stanford.

This action-oriented method will be applied throughout the entire academic itinerary that the student undertakes with TECH. Students will be confronted with multiple real-life situations and will have to integrate knowledge, research, discuss and defend their ideas and decisions. All this with the premise of answering the question of how they would act when facing specific events of complexity in their daily work.

Relearning Methodology

At TECH, case studies are enhanced with the best 100% online teaching method: Relearning.

This method breaks with traditional teaching techniques to put the student at the center of the equation, providing the best content in different formats. In this way, it manages to review and reiterate the key concepts of each subject and learn to apply them in a real context.

In the same line, and according to multiple scientific researches, reiteration is the best way to learn. For this reason, TECH offers between 8 and 16 repetitions of each key concept within the same lesson, presented in a different way, with the objective of ensuring that the knowledge is completely consolidated during the study process.

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.

A 100% online Virtual Campus with the best teaching resources

In order to apply its methodology effectively, TECH focuses on providing graduates with teaching materials in different formats: texts, interactive videos, illustrations and knowledge maps, among others. All of them are designed by qualified teachers who focus their work on combining real cases with the resolution of complex situations through simulation, the study of contexts applied to each professional career and learning based on repetition, through audios, presentations, animations, images, etc.

The latest scientific evidence in the field of Neuroscience points to the importance of taking into account the place and context where the content is accessed before starting a new learning process. Being able to adjust these variables in a personalized way helps people to remember and store knowledge in the hippocampus to retain it in the long term. This is a model called Neurocognitive context-dependent e-learning that is consciously applied in this university qualification.

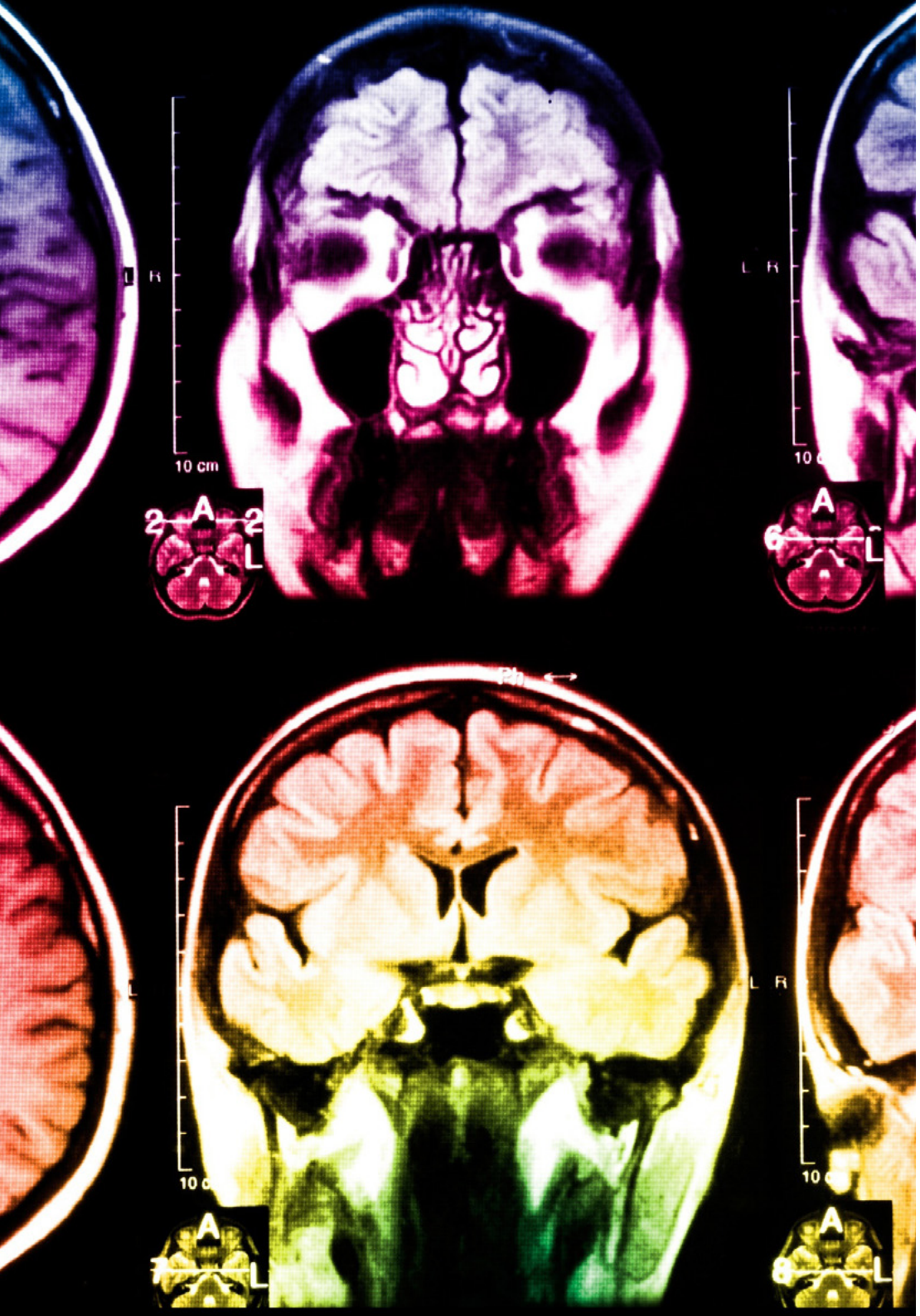
In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

Likewise, this very complete Virtual Campus will allow TECH students to organize their study schedules according to their personal availability or work obligations. In this way, they will have global control of the academic content and teaching tools, based on their fast-paced professional update.

The online study mode of this program will allow you to organize your time and learning pace, adapting it to your schedule"

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 assess 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.



The university methodology top-rated by its students

The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

The students' assessment of the teaching quality, the quality of the materials, the structure of the program and its objectives is excellent. Not surprisingly, the institution became the top-rated university by its students according to the global score index, obtaining a 4.9 out of 5.

Access the study contents from any device with an Internet connection (computer, tablet, smartphone) thanks to the fact that TECH is at the forefront of technology and teaching.

You will be able to learn with the advantages that come with having access to simulated learning environments and the learning by observation approach, that is, Learning from an expert.

As such, the best educational materials, thoroughly prepared, will be available in this program:

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.

This content is then adapted in an audiovisual format that will create our way of working online, with the latest techniques that allow us to offer you high quality in all of the material that we provide you with.

Practicing Skills and Abilities

You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.

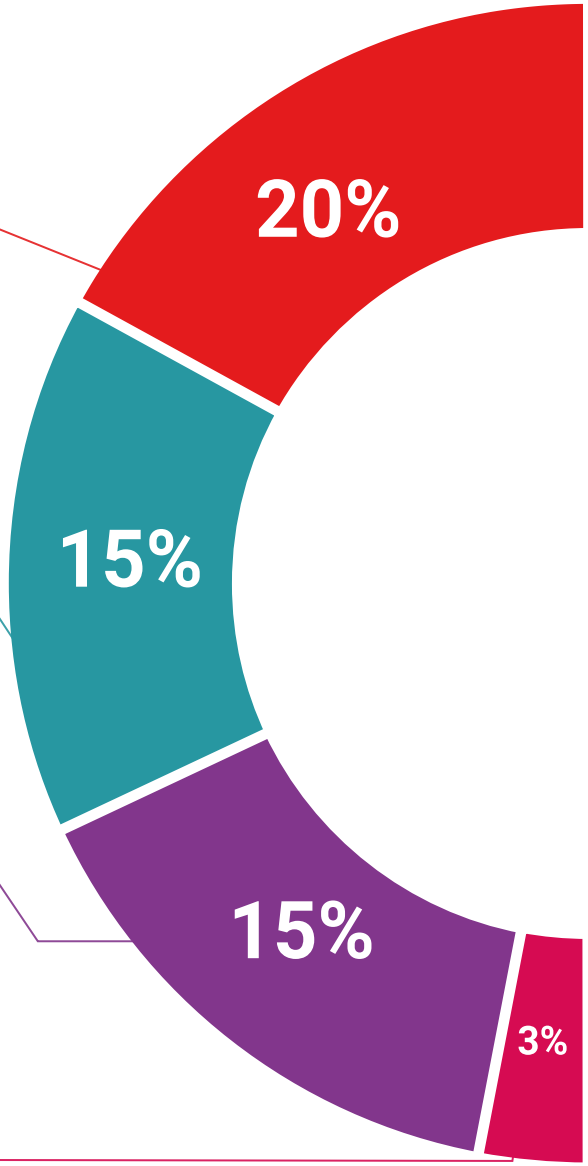
Interactive Summaries

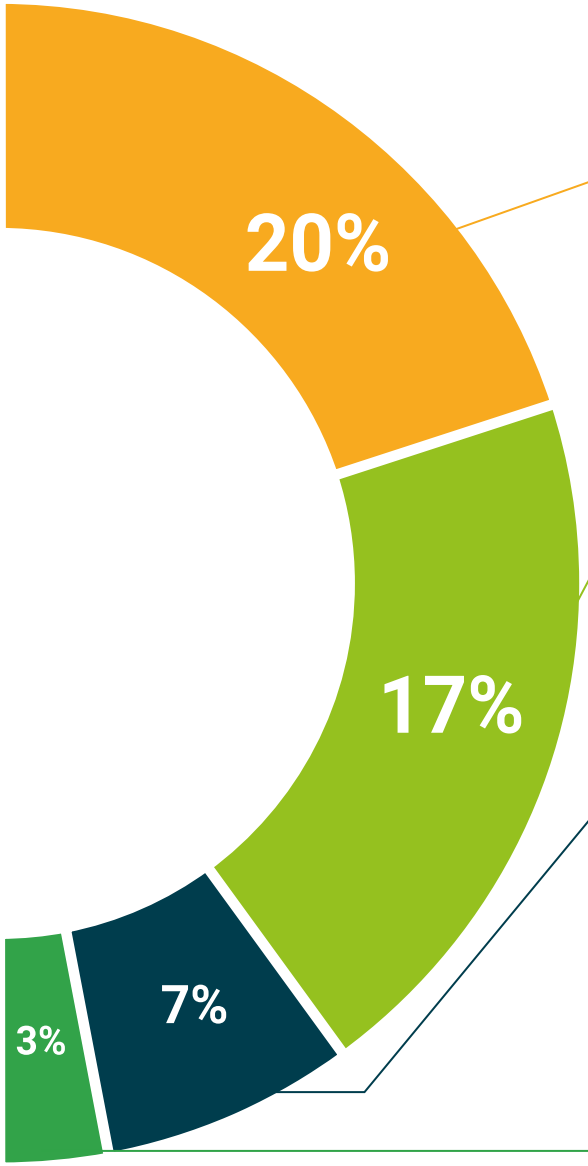
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

Additional Reading

Recent articles, consensus documents, international guides... In our virtual library you will have access to everything you need to complete your education.





Case Studies

Students will complete a selection of the best case studies in the field. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Testing & Retesting

We periodically assess and re-assess your knowledge throughout the program. We do this on 3 of the 4 levels of Miller's Pyramid.

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 for 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.

05

Certificate

This Postgraduate Certificate in Medical Physics guarantees students, in addition to the most rigorous and up-to-date education, access to a diploma for the Postgraduate Certificate issued by TECH Global University.

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

This private qualification will allow you to obtain a diploma for the **Postgraduate Certificate in Medical Physics** endorsed by TECH Global University, the world's largest online university.

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

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

Title: **Postgraduate Certificate in Medical Physics**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**


tech global university

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

Postgraduate Certificate in Medical Physics

This is a private qualification of 180 hours of duration equivalent to 6 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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

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

Dr. Pedro Navarro Illana
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 Global University will make the necessary arrangements to obtain it, at an additional cost.

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