Postgraduate Diploma
Medical Physics

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Postgraduate Diploma
Medical Physics

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

Website: **www.techtitute.com/pk/engineering/postgraduate-diploma/postgraduate-diploma-medical-physics**

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01

Introduction

New technologies have made possible to advance in the creation of more precise devices for the detection and treatment of patients through, for example, radiology or laser equipment. These advances are possible thanks to the knowledge acquired by engineering specialists in Medical Physics. A highly demanded branch, especially in the field of the study of the treatment of patients with serious diseases such as cancer. For this reason, this academic institution has created a 100% online program, which provides the student with the most advanced knowledge on remote sensing and image processing, biophysics or the physical principles on which radiation therapies are based. All this will also be possible thanks to the multimedia content developed by the teaching team of this program.

With this Postgraduate Diploma you will be able to delve into Medical Physics and obtain in only 6 months the learning you need to progress in your career"

Detecting a person's vital functions in real time through a device, using more precise radiotherapy techniques on lung cancer or improving diagnostic equipment are just some of the contributions by Medical Physics together with Engineering.

Progress in this field has a direct impact on people's well-being, while contributing to an even better understanding of how the human body works. A deep and advanced knowledge in a branch of physics, which requires more and more specialized engineering professionals. In this context, this Postgraduate Diploma in Medical Physics is created, which seeks to provide the graduates with the most intensive learning and direct application in their daily work.

Thus, through the most innovative teaching tools (video summaries, videos in detail, diagrams or maps), students will be able to delve in a much more dynamic way into the main concepts of Medical Physics, the physical phenomena that act on cells and living organisms or advances in Machine Learning and data analysis. All this with a theoretical-practical approach, complemented by case study simulations provided by the experts who teach this degree.

In addition, in this academic teaching, this institution uses the Relearning method, based on the reiteration of content, which allows students to progress more naturally through the syllabus while reducing the long hours of study.

The student is therefore faced with an excellent opportunity to advance in their professional career through a Postgraduate Diploma that they can access comfortably, whenever and wherever they wish. All you need is an electronic device (computer, tablet or cell phone) with an internet connection to access, at any time, the contents of the virtual campus. In addition, students are free to distribute the course load according to their needs. An ideal educational option for people who wish to combine their work and/or personal responsibilities with quality education.

This **Postgraduate Diploma 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 practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

With this university education you will be able to approach to the improvements in imaging achieved by histogram modification"

Enroll now in a university degree that will allow you to obtain the necessary knowledge to contribute to the creation of devices for the treatment of serious diseases"

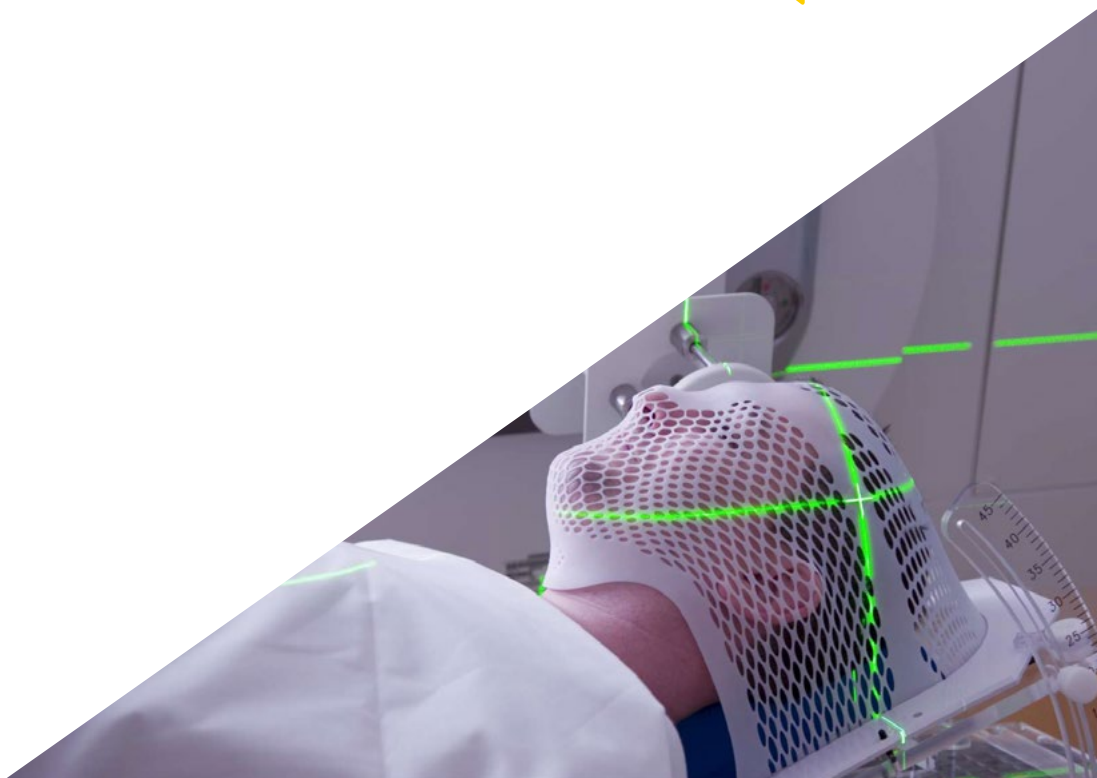
Video summaries, specialized readings or videos in detail constitute the main multimedia resources to which you will have access 24 hours a day.

In this program, you will be able to delve into studies focused on passive remote sensing in ultraviolet, visible, infrared, microwave and radio.

The program's teaching staff includes professionals from the sector 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 student will be assisted by an innovative interactive video system created by renowned and experienced experts.



02

Objectives

TECH has designed this Postgraduate Diploma with the aim of offering the professionals an intensive learning on Medical Physics, which will allow them to progress in this field. Thus, upon completion of this program, they will be able to master the main techniques used for remote sensing and image processing, the software used, as well as the main physical principles used for diagnostic imaging.

A 100% online academic option that leads you to reflect on the chaos in biological systems"

General Objectives

- Be able to explain the behaviors using the basic equations of fluid dynamics
- Understand the four principles of thermodynamics and apply them to the study of thermodynamic systems
- Apply processes of analysis, synthesis and critical reasoning
- Know the main principles on which Medical Physics is based
- Understand the concepts of 3D and 4D segmentation and processing
- Be aware of advances in remote sensing and image processing
- Understand the main characteristics of nuclear medicine

The multimedia resource library will take you to delve into the physical principles of radiation therapies and the applications of nuclear medicine"

Specific Objectives

Module 1. Remote Sensing and Image Processing

- Achieve basic knowledge of medical and atmospheric image processing and its applications in the corresponding fields of medical and atmospheric physics, respectively
- Acquire skills in image optimization, registration and fusion
- Know the basics of machine learning and data analysis

Module 2. Biophysics

- Know the characteristics of the living systems from the physical point of view
- Acquire basic knowledge about the different types of transport through cell membranes and how they work
- Know the mathematical relationships that model biological processes
- Acquire basic notions about the physics of nerve impulses

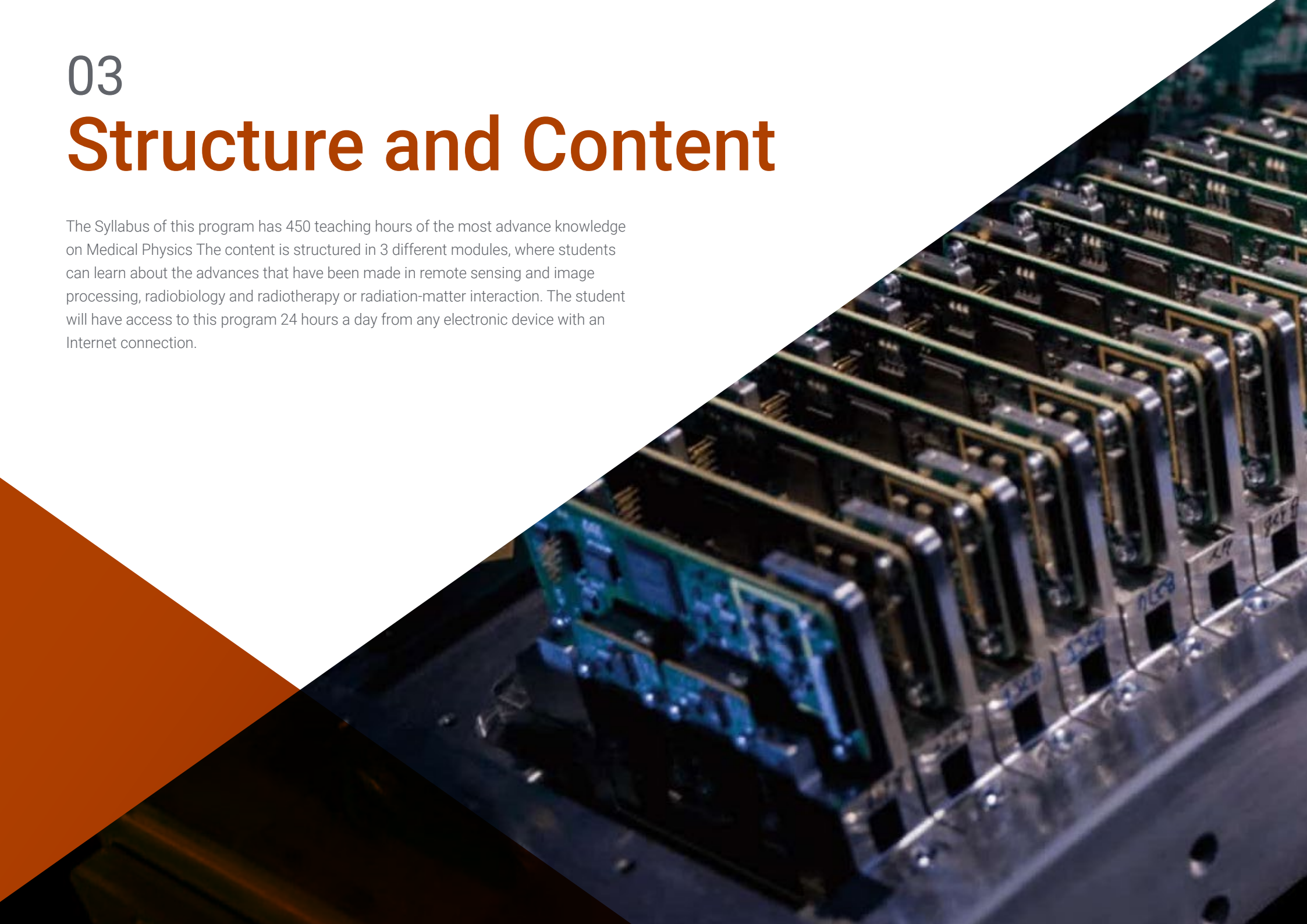
Module 3. Medical Physics

- Study the concepts of metrology and dosimetry of ionizing radiation
- Understand the physical principles of diagnostic imaging
- Identify the physical principles and practical applications of nuclear medicine
- Understand the physical principles on which radiation therapy is based

03

Structure and Content

The Syllabus of this program has 450 teaching hours of the most advance knowledge on Medical Physics The content is structured in 3 different modules, where students can learn about the advances that have been made in remote sensing and image processing, radiobiology and radiotherapy or radiation-matter interaction. The student will have access to this program 24 hours a day from any electronic device with an Internet connection.



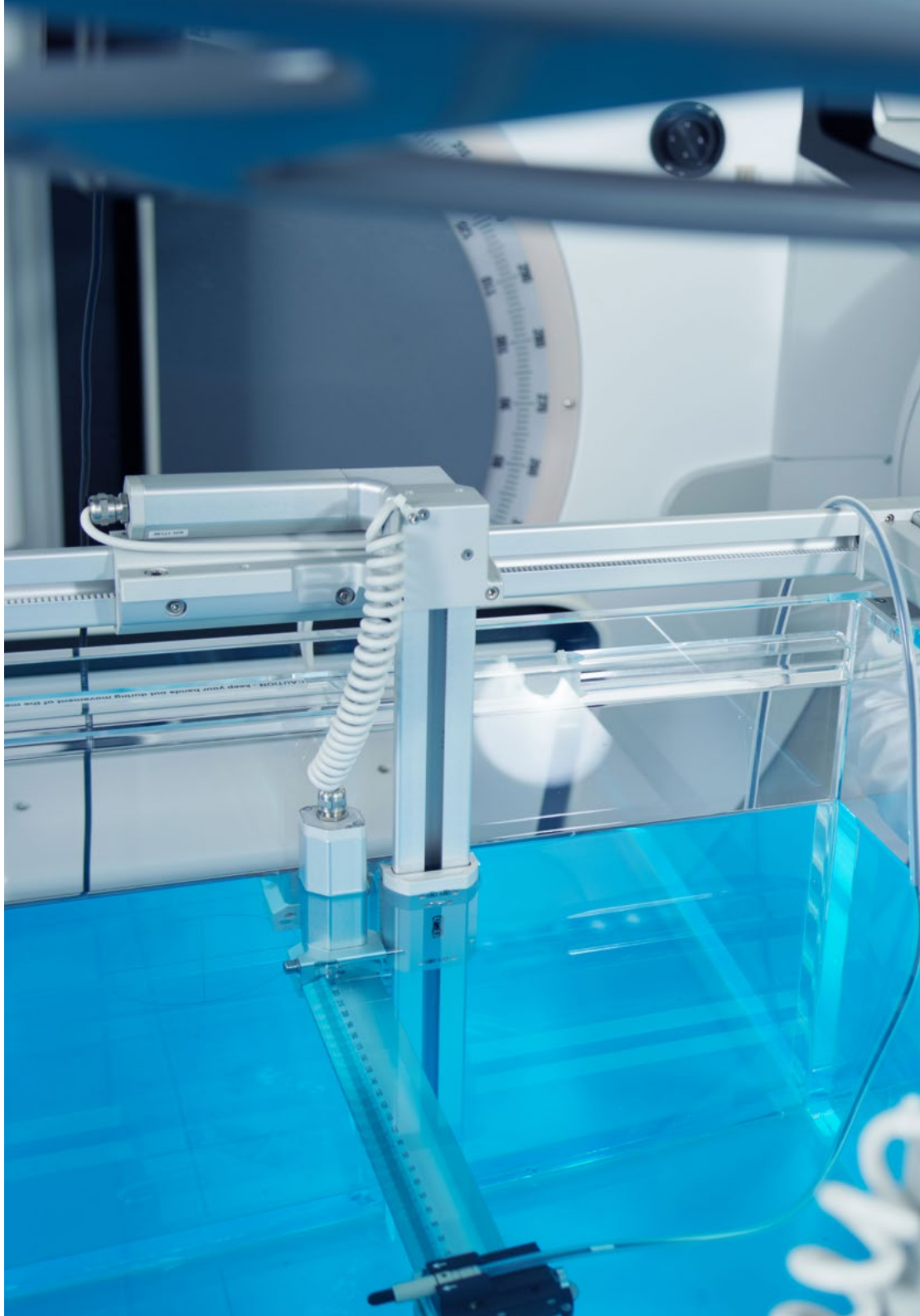
TECH adapts to you and therefore has designed a Postgraduate Diploma that you can access 24 hours a day and without classes with fixed schedules"

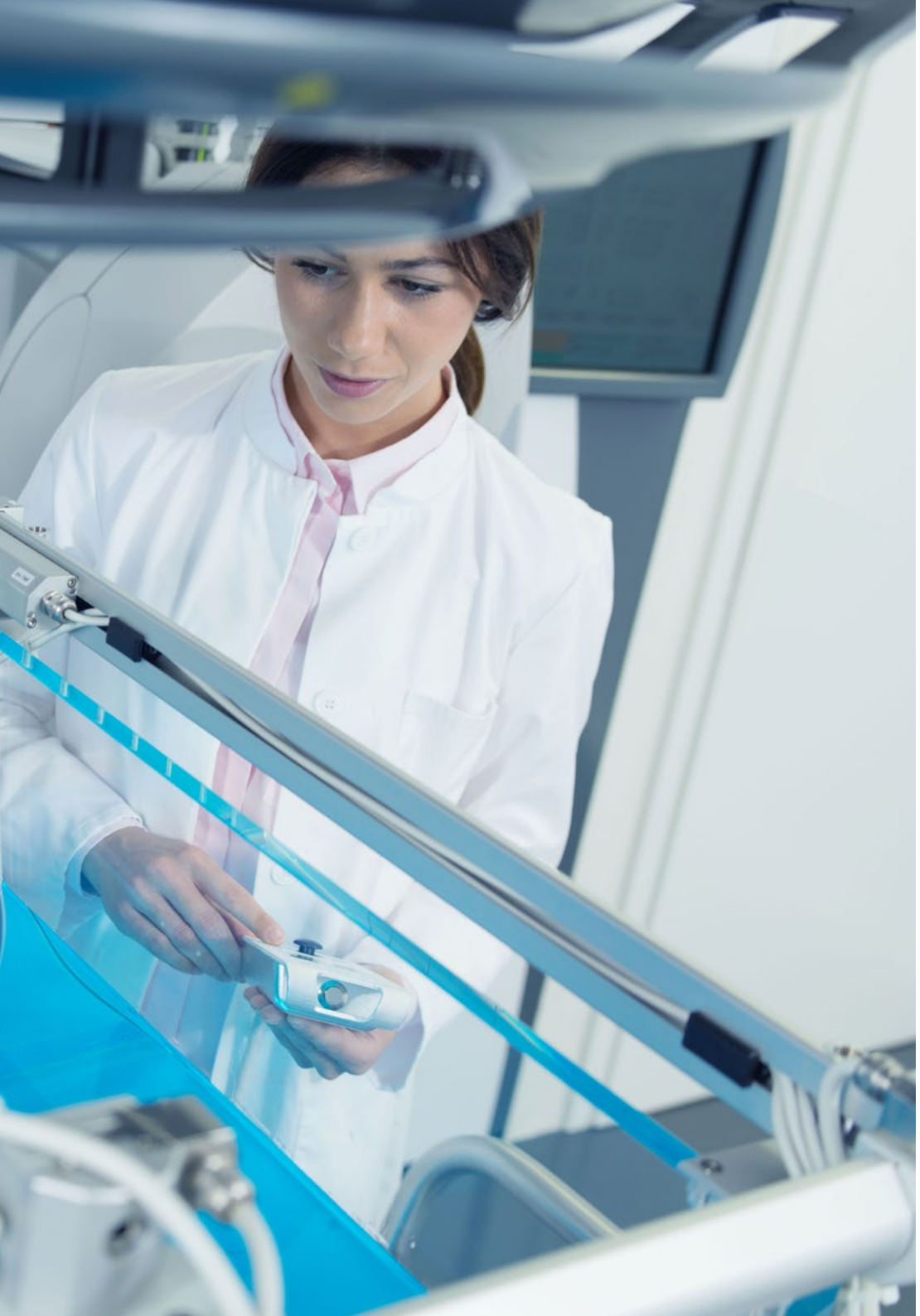
Module 1. Remote Sensing and Image Processing

1.1. Introduction to Image Processing
- 1.1.1. Motivation
- 1.1.2. Digital Medical and Atmospheric Imaging
- 1.1.3. Modalities of Medical and Atmospheric Imaging
- 1.1.4. Quality Parameters
- 1.1.5. Storage and Display
- 1.1.6. Processing Platforms
- 1.1.7. Image Processing Applications

1.2. Image Optimization, Registration and Fusion
- 1.2.1. Introduction and Objectives
- 1.2.2. Intensity Transformations
- 1.2.3. Noise Correction
- 1.2.4. Filters in the Spatial Domain
- 1.2.5. Frequency Domain Filters
- 1.2.6. Introduction and Objectives
- 1.2.7. Geometric Transformations
- 1.2.8. Records
- 1.2.9. Multimodal Merging
- 1.2.10. Applications of Multimodal Fusion

1.3. 3D and 4D Segmentation and Processing Techniques
- 1.3.1. Introduction and Objectives
- 1.3.2. Segmentation Techniques
- 1.3.3. Morphological Operations
- 1.3.4. Introduction and Objectives
- 1.3.5. Morphological and Functional Imaging
- 1.3.6. 3D Analysis
- 1.3.7. 4D Analysis





1.4. Feature Extraction
- 1.4.1. Introduction and Objectives
- 1.4.2. Texture Analysis
- 1.4.3. Morphometric Analysis
- 1.4.4. Statistics and Classification
- 1.4.5. Presentation of Results

1.5. Machine Learning
- 1.5.1. Introduction and Objectives
- 1.5.2. Big Data
- 1.5.3. Deep Learning
- 1.5.4. Software Tools
- 1.5.5. Applications
- 1.5.6. Limitations

1.6. Introduction to Remote Sensing
- 1.6.1. Introduction and Objectives
- 1.6.2. Definition of Remote Sensing
- 1.6.3. Exchange Particles in Remote Sensing
- 1.6.4. Active and Passive Remote Sensing
- 1.6.5. Remote Sensing Software with Python

1.7. Passive Photon Remote Sensing
- 1.7.1. Introduction and Objectives
- 1.7.2. Light
- 1.7.3. Interaction of Light with Matter
- 1.7.4. Black Bodies
- 1.7.5. Other Effects
- 1.7.6. Point Cloud Diagram

1.8. Passive Remote Sensing in Ultraviolet, Visible, Infrared, Infrared, Microwave and Radio
- 1.8.1. Introduction and Objectives
- 1.8.2. Passive Remote Sensing: Photon Detectors
- 1.8.3. Visible Observation with Telescopes
- 1.8.4. Types of Telescopes
- 1.8.5. Mounts
- 1.8.6. Optics
- 1.8.7. Ultraviolet
- 1.8.8. Infrared
- 1.8.9. Microwaves and Radio Waves
- 1.8.10. netCDF4 Files

1.9. Active Remote Sensing with Lidar and Radar
- 1.9.1. Introduction and Objectives
- 1.9.2. Active Remote Sensing
- 1.9.3. Atmospheric Radar
- 1.9.4. Weather Radar
- 1.9.5. Comparison of Lidar with Radar
- 1.9.6. HDF4 Files

1.10. Passive Remote Sensing of Gamma and X-Rays
- 1.10.1. Introduction and Objectives
- 1.10.2. Introduction to X-ray Observation
- 1.10.3. Gamma Ray Observation
- 1.10.4. Remote Sensing Software

Module 2. Biophysics

2.1. Introduction to Biophysics
- 2.1.1. Introduction to Biophysics
- 2.1.2. Characteristics of Biological Systems
- 2.1.3. Molecular Biophysics
- 2.1.4. Cell Biophysics
- 2.1.5. Biophysics of Complex Systems

2.2. Introduction to the Thermodynamics of Irreversible Processes
- 2.2.1. Generalization of the Second Principle of Thermodynamics for Open Systems
- 2.2.2. Dissipation Function
- 2.2.3. Linear Relationships between Conjugate Thermodynamic Fluxes and Forces
- 2.2.4. Validity Interval of the Linear Thermodynamics
- 2.2.5. Properties of Phenomenological Coefficients
- 2.2.6. Onsager's Relations
- 2.2.7. Theorem of Minimum Entropy Production
- 2.2.8. Stability of Steady States in the Vicinity of Equilibrium. Stability Criteria
- 2.2.9. Processes Far from Equilibrium
- 2.2.10. Evolution Criteria

2.3. Arrangement in Time: Irreversible Processes away from Equilibrium
- 2.3.1. Kinetic Processes Considered as Differential Equations
- 2.3.2. Stationary Solutions
- 2.3.3. Lotka-Volterra Model
- 2.3.4. Stability of Stationary Solutions: Perturbation Method
- 2.3.5. Trajectories: Solutions of the Systems of Differential Equations
- 2.3.6. Types of Stability
- 2.3.7. Analysis of the Stability in the Lotka-Volterra Model
- 2.3.8. Timing: Biological Clocks
- 2.3.9. Structural Stability and Bifurcations. Brusselator's Model
- 2.3.10. Classification of the Different Types of Dynamic Behavior

2.4. Spatial Arrangement: Systems with Diffusion
- 2.4.1. Spatial-Temporal Self-Organization
- 2.4.2. Reaction-Diffusion Equations
- 2.4.3. Solutions of These Equations
- 2.4.4. Examples:

2.5. Chaos in Biological Systems
- 2.5.1. Introduction
- 2.5.2. Attractors. Strange or Chaotic Attractors
- 2.5.3. Definition and Properties of Chaos
- 2.5.4. Ubiquity: Chaos in Biological Systems
- 2.5.5. Universality: Routes to Chaos
- 2.5.6. Fractal Structure Fractals
- 2.5.7. Fractal Properties
- 2.5.8. Reflections on Chaos in Biological Systems

2.6. Membrane Potential Biophysics
- 2.6.1. Introduction
- 2.6.2. First Approach to the Membrane Potential: Nernst Potential
- 2.6.3. Gibbs-Donnan Potentials
- 2.6.4. Surface Potentials

2.7. Transport across Membranes: Passive Transport
- 2.7.1. Nernst-Planck Equation
- 2.7.2. Constant Field Theory
- 2.7.3. GHK Equation in Complex Systems
- 2.7.4. Fixed Charge Theory
- 2.7.5. Action Potential Transmission
- 2.7.6. TPI Transport Analysis
- 2.7.7. Electrokinetic Phenomena

2.8. Facilitated Transport. Ion Channels Transporters
- 2.8.1. Introduction
- 2.8.2. Characteristics of Transport Facilitated by Transporters and Ion Channels
- 2.8.3. Model of Oxygen Transport with Hemoglobin Thermodynamics of Irreversible Processes
- 2.8.4. Examples

2.9. Active Transport: Effect of Chemical Reactions on Transport Processes
- 2.1.1. Chemical Reactions and Steady State Concentration Gradients
- 2.1.2. Phenomenological Description of Active Transport
- 2.1.3. The Sodium-Potassium Pump
- 2.1.4. Oxidative Phosphorylation

2.10. Nervous Impulses
- 2.10.1. Phenomenology of the Action Potential
- 2.10.2. Mechanism of the Action Potential
- 2.10.3. Hodgkin-Huxley Mechanism
- 2.10.4. Nerves, Muscles and Synapses

Module 3. Medical Physics

3.1. Natural and Artificial Radiation Sources
- 3.1.1. Alpha, Beta and Gamma Emitting Nuclei
- 3.1.2. Nuclear Reactions
- 3.1.3. Neutron Sources
- 3.1.4. Charged Particle Accelerators
- 3.1.5. X-Ray Generators

3.2. Radiation-Matter Interaction
- 3.2.1. Photon Interactions (Rayleigh and Compton Scattering, Photoelectric Effect and Electron-Positron Pair Creation)
- 3.2.2. Electron-Positron Interactions (Elastic and Inelastic Collisions, Emission of Braking Radiation or Bremsstrahlung and Positron Annihilation)
- 3.2.3. Ion Interactions
- 3.2.4. Neutron Interactions

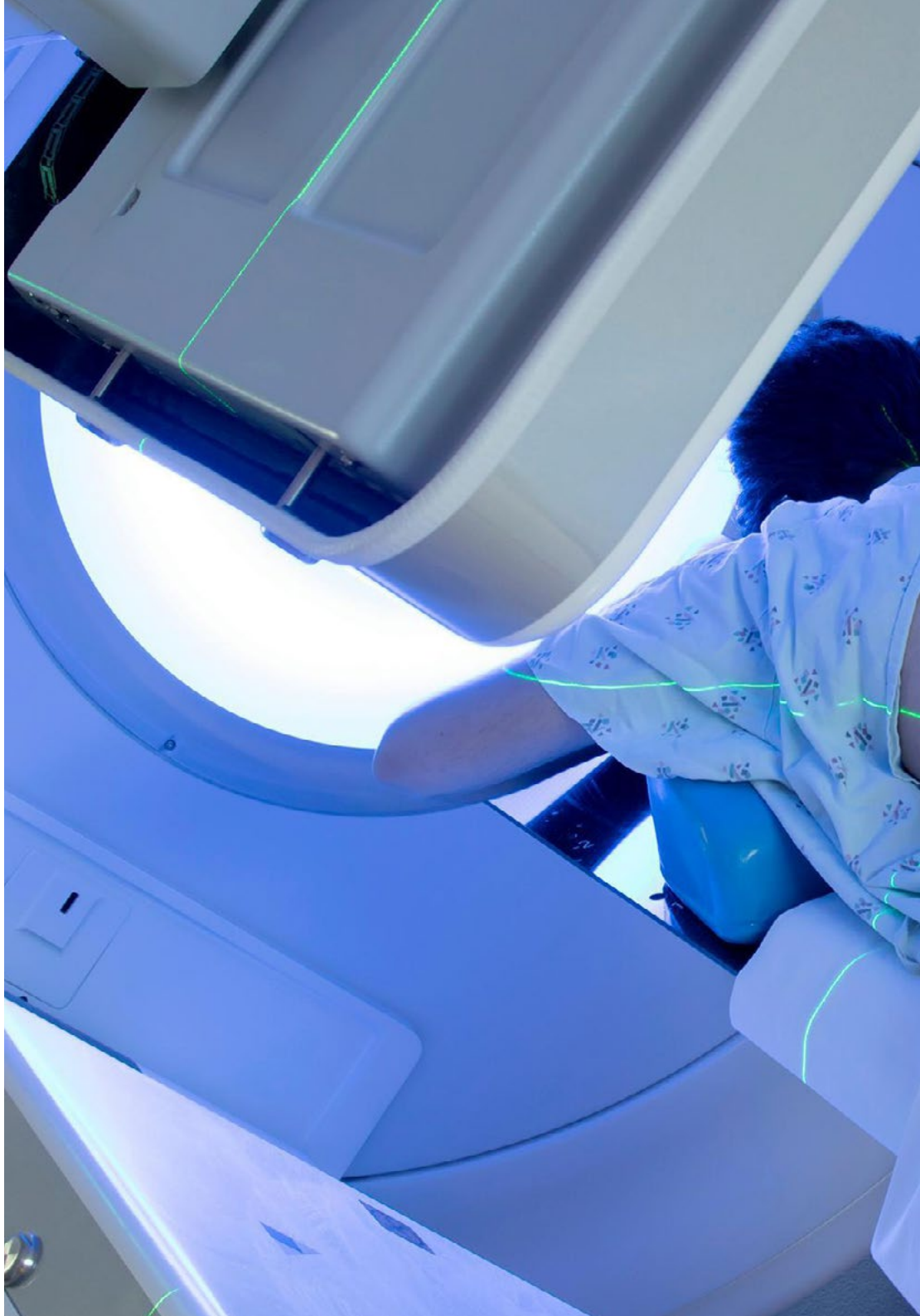
3.3. Monte Carlo Simulation of Radiation Transport
- 3.3.1. Pseudorandom Number Generation
- 3.3.2. Random Number Drawing Techniques
- 3.3.3. Radiation Transport Simulation
- 3.3.4. Practical Examples

3.4. Dosimetry
- 3.4.1. Dosimetric Quantities and Units (ICRU)
- 3.4.2. External Exposure
- 3.4.3. Radionuclides Incorporated in the Organism
- 3.4.4. Radiation-Matter Interaction
- 3.4.5. Radiological Protection
- 3.4.6. Permitted Limits for the Public and Professionals

3.5. Radiobiology and Radiotherapy
- 3.5.1. Radiobiology
- 3.5.2. External Radiation Therapy with Photons and Electrons
- 3.5.3. Brachytherapy
- 3.5.4. Advanced Processing Methods (Ions and Neutrons)
- 3.5.5. Planning

3.6. Biomedical Images
- 3.6.1. Biomedical Imaging Techniques
- 3.6.2. Image Enhancement using Histogram Modification
- 3.6.3. Fourier Transform
- 3.6.4. Filtering
- 3.6.5. Restoration

3.7. Nuclear Medicine
- 3.7.1. Tracers
- 3.7.2. Detector Equipment
- 3.7.3. Gamma Camera
- 3.7.4. Planar Scintigraphy
- 3.7.5. SPECT
- 3.7.6. PET:
- 3.7.7. Small Animal Equipment



3.8. Reconstruction Algorithms
- 3.8.1. Radon Transform
- 3.8.2. Central Section Theorem
- 3.8.3. Filtering Back Projection Algorithm
- 3.8.4. Noise Filtering
- 3.8.5. Iterative Reconstruction Algorithms
- 3.8.6. Algebraic Algorithm (ART)
- 3.8.7. Maximum Likelihood Algorithm (MLE)
- 3.8.8. Ordered Subsites (OSEM)

3.9. Biomedical Image Reconstruction
- 3.9.1. SPECT Reconstruction
- 3.9.2. Degrading Effects Associated with Photon Attenuation, Scattering, System Response, and Noise
- 3.9.3. Compensation in the Filtered Back Projection Algorithm
- 3.9.4. Compensation in Iterative Methods

3.10. Radiology and Magnetic Resonance Imaging (MRI)
- 3.10.1. Imaging Techniques in Radiology: Radiography and CT
- 3.10.2. Introduction to MRI
- 3.10.3. MRI Imaging
- 3.10.4. MRI Spectroscopy
- 3.10.5. Quality Control

An academic option that will lead you to know the main characteristics of molecular and cellular biophysics and complex systems"

02

Methodology

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

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

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

Case Study to contextualize all content

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

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

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

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

A learning method that is different and innovative

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

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

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

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

Relearning Methodology

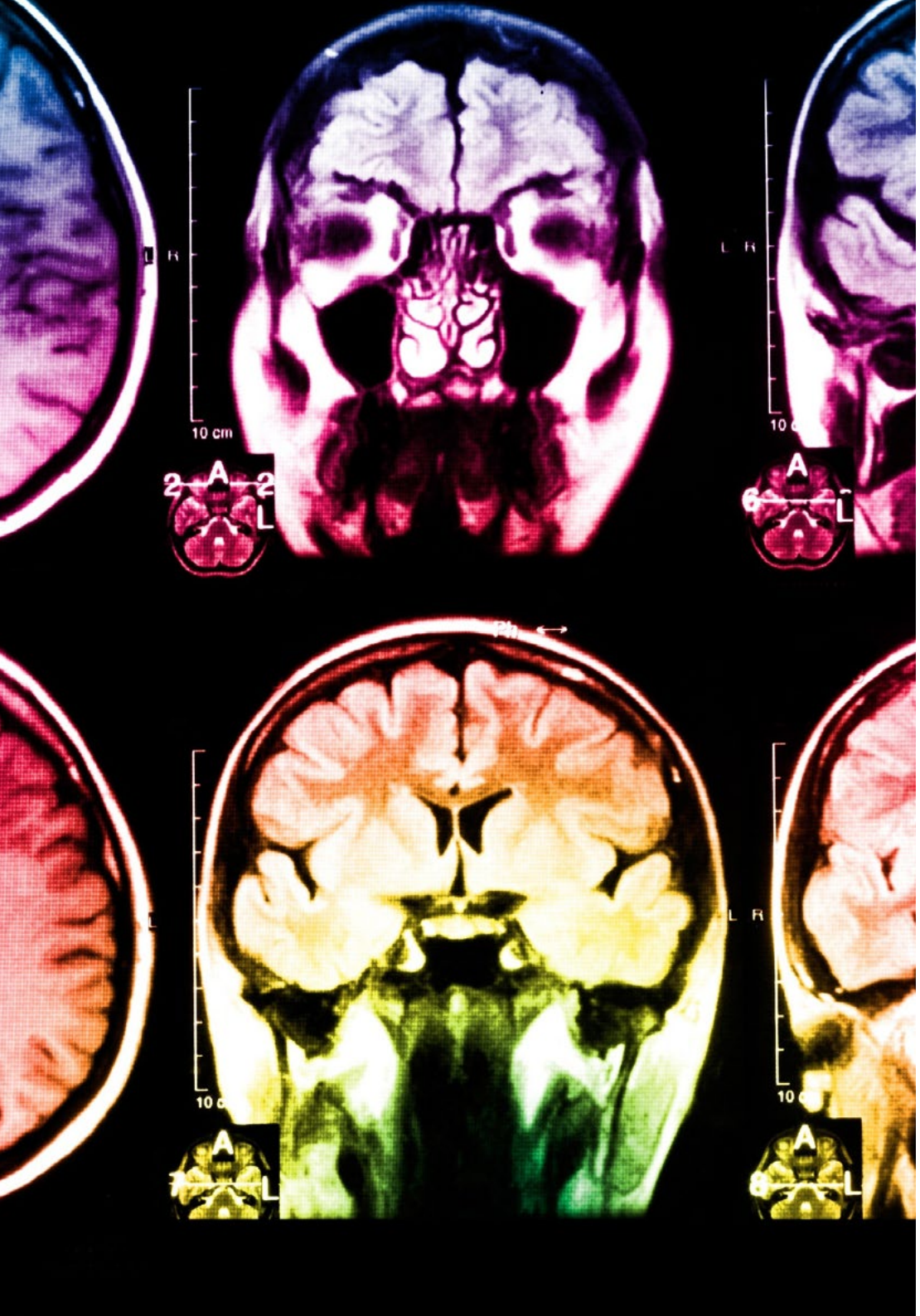
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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

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

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

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



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

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

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

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

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

Study Material

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

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

Classes

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

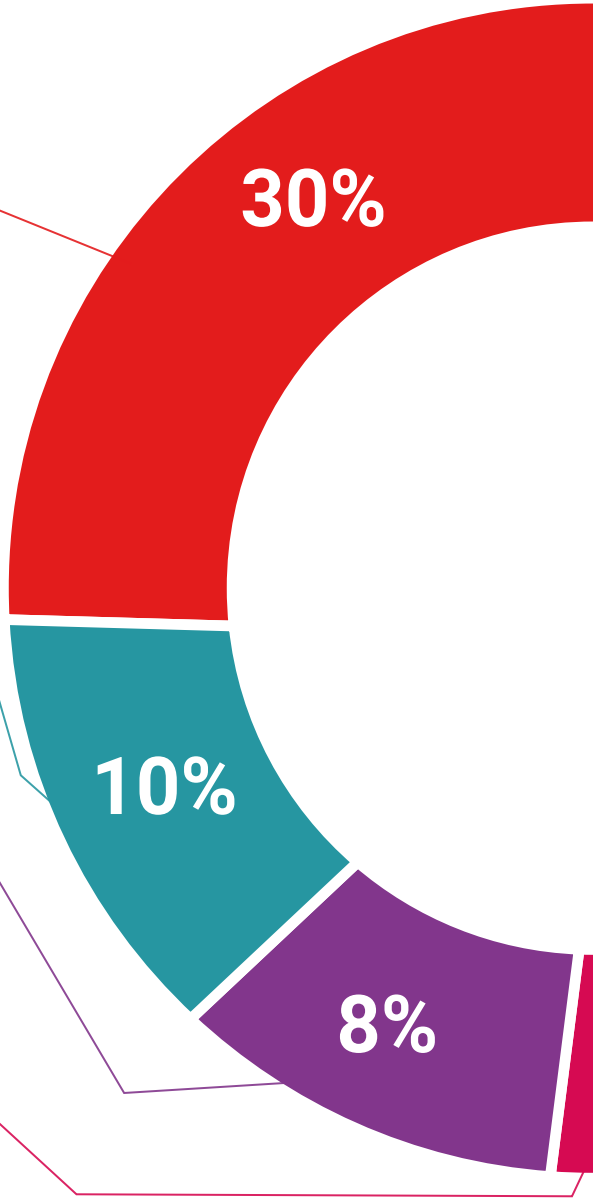
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

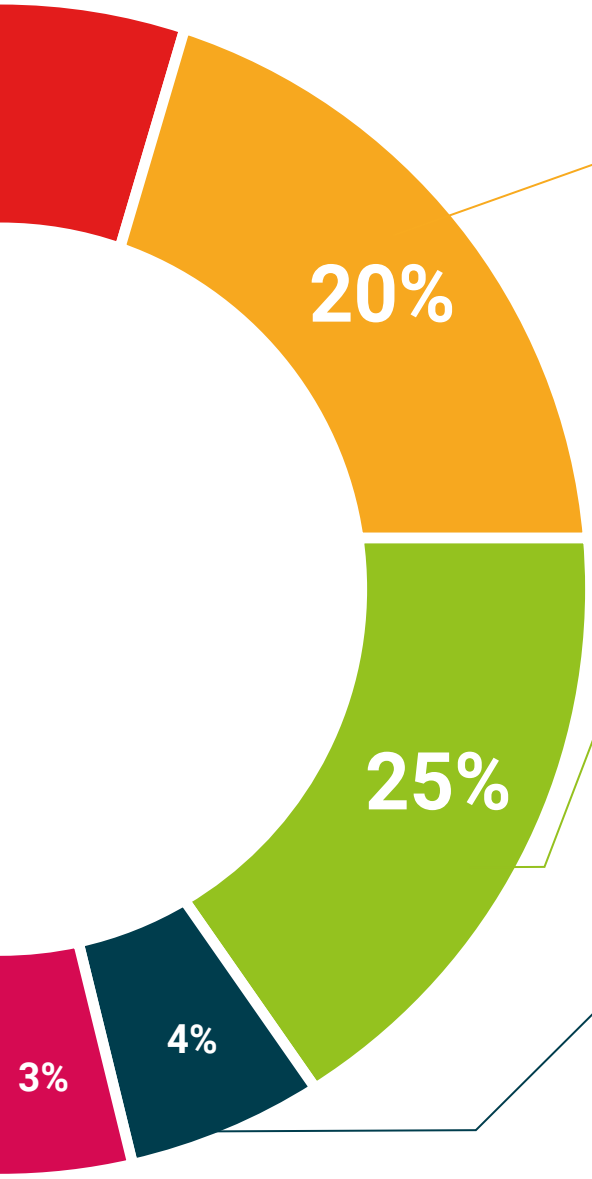
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

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

Interactive Summaries

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

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

Testing & Retesting

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

05

Certificate

This Postgraduate Diploma in Medical Physics 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 Medical Physics** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma in Medical Physics**

Official N° of hours: **450 h.**


tech technological university

Awards the following

CERTIFICATE

to

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

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Medical Physics

This is a qualification awarded by this University, equivalent to 450 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

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

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

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