

Postgraduate Certificate Biomedical Physics





Postgraduate Certificate Biomedical Physics

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

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

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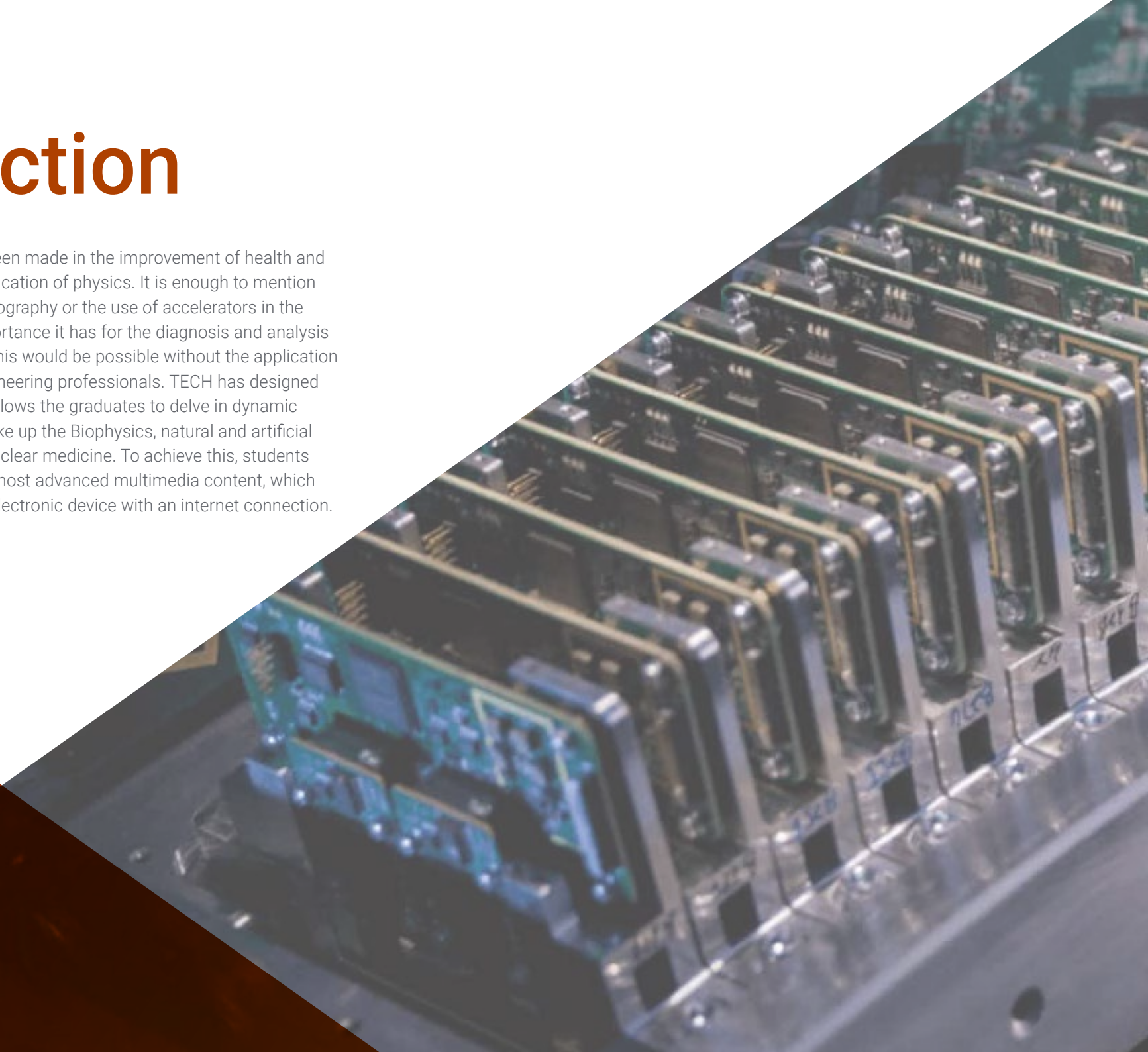
Certificate

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01

Introduction

Many of the advances that have been made in the improvement of health and biomedicine are based on the application of physics. It is enough to mention magnetic resonance imaging, tomography or the use of accelerators in the health field to understand the importance it has for the diagnosis and analysis of pathologies. However, none of this would be possible without the application of the technical knowledge of engineering professionals. TECH has designed this 100% online program, which allows the graduates to delve in dynamic way into the key concepts that make up the Biophysics, natural and artificial radiation sources or progress in nuclear medicine. To achieve this, students have 24-hour a day access to the most advanced multimedia content, which can be easily accessed from any electronic device with an internet connection.



“

In only 12 weeks, the teaching team of this Postgraduate Certificate will provide you with the knowledge and techniques necessary to advance in Biomedical Physics”

The methods of diagnosis and analysis of diseases in the field of health care have improved in the last few years thanks to the development of new technologies and studies in this field. This progress is particularly noticeable in computed tomography, where the quality of the imaging tests or the equipment used to carry out the quality of imaging tests or the equipment used to perform magnetic resonance imaging has been improved.

This work is supported by Physics, which has led to important advances in the fusion of Biology and Medicine. Also completing this vertex are the highly qualified engineering professionals who are responsible for the availability of these instruments. In order to further enhance this field, TECH has created this Postgraduate Certificate in Biomedical Physics, which offers the graduates an intensive and advanced learning that will lead to boost their career.

A program where, in just 12 weeks, you will gain the necessary knowledge about the mathematical relationships that model biological processes, the physics of nerve impulses, advances in biomedical imaging or key concepts in radiology and Magnetic Resonance Imaging (MRI). The multimedia resources and case studies developed by the specialized teaching team that is part of this program will contribute to the theoretical-practical approach required in this teaching.

In this way, students who take this program have an excellent opportunity to advance in their field of work in Biomedical Physics, thanks to a Postgraduate Certificate that can be taken whenever and wherever they wish. All you need is a computer, tablet or cell phone with internet connection to be able to view its contents at any time. Moreover, the syllabus can be distributed according to your needs, which makes this instruction an ideal educational option for those seeking to combine a quality university program with the most demanding responsibilities.

This **Postgraduate Certificate in Biomedical 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 it is designed provide advanced and practical information on those disciplines that are essential for professional practice
- ◆ Practical exercises where the self-assessment process can be carried out to improve learning
- ◆ Its special emphasis on innovative methodologies
- ◆ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ◆ Content that is accessible from any fixed or portable device with an Internet connection



Thanks to this teaching you will get an advanced learning about radiology and Nuclear Magnetic Resonance (NMR)”

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Take a step further in the field of Engineering and acquire with this Postgraduate Certificate the necessary knowledge to develop diagnostic equipment in the health field”

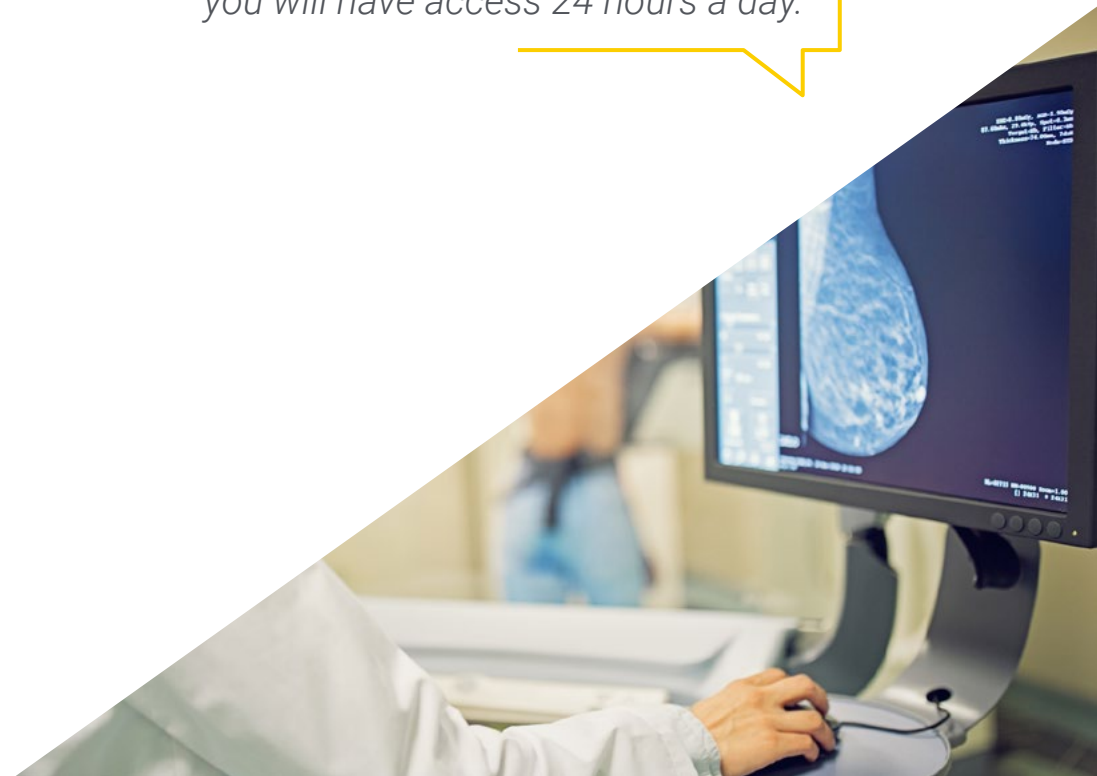
The program’s teaching staff includes professionals from the sector who bring to this program the experience of their work, in addition to recognized specialists from prestigious reference societies and universities.

Its 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 an immersive education programmed to learn in real situations.

This program is designed around Problem-Based Learning, whereby the professionals must try to solve the different professional practice situations that arise throughout the Postgraduate Certificate. For this purpose, students will be assisted by an innovative interactive video system created by renowned and experienced experts.

The practical cases of this program will lead you to understand in a much simpler way the Monte Carlo simulation of radiation transport.

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



02 Objectives

Upon completion of this program, students will have expanded their skills and competencies, and will be able to understand the physical principles of diagnostic imaging, the effects of radiation on living beings, as well as the practical applications of nuclear medicine. The experts who teach this Postgraduate Certificate will accompany the graduates to successfully achieve the objectives set in this teaching.





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With this program, you will learn about the advances achieved thanks to the use of physical principles in Biomedicine”

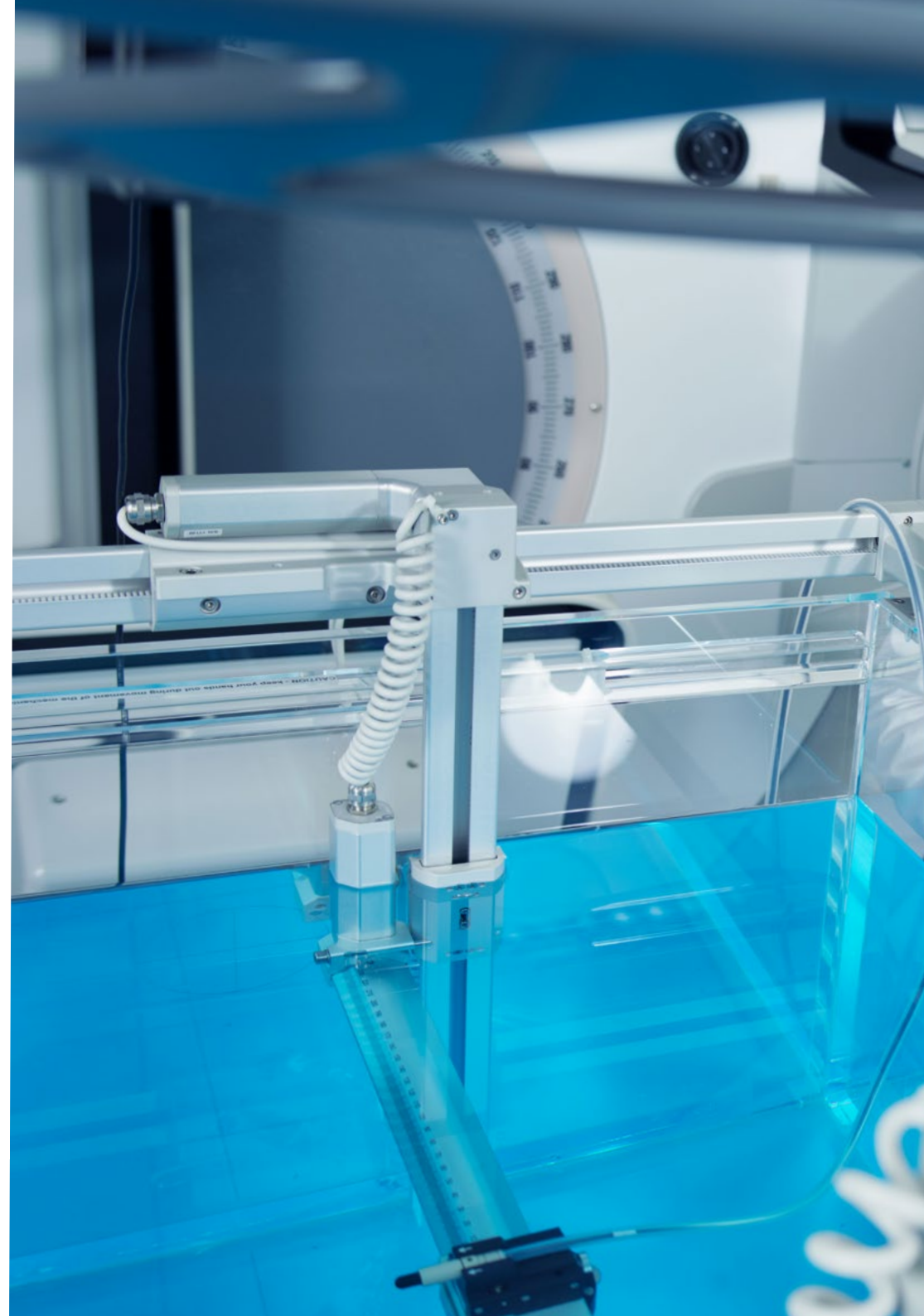


General Objectives

- ◆ Know the characteristics of the living systems from the physical point of view
- ◆ Understand the physical principles of diagnostic Imaging
- ◆ Understand the principles of radiation protection and the quantities and units used in radiation protection systems
- ◆ Analyze the effects of ionizing radiation on living beings



Enroll now in a 100% online Postgraduate Certificate, without classes with fixed schedules and compatible with professional responsibilities”





Specific Objectives

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

03

Structure and Content

TECH uses the Relearning method, based on the reiteration of content, which favors the consolidation of knowledge in a more natural and progressive way. In this way, students will learn about biophysics, the concepts of transport through membranes, the arrangement in space or the latest advances in radiobiology and radiotherapy. Moreover, this knowledge can be accessed 24 hours a day from any electronic device with an internet connection.





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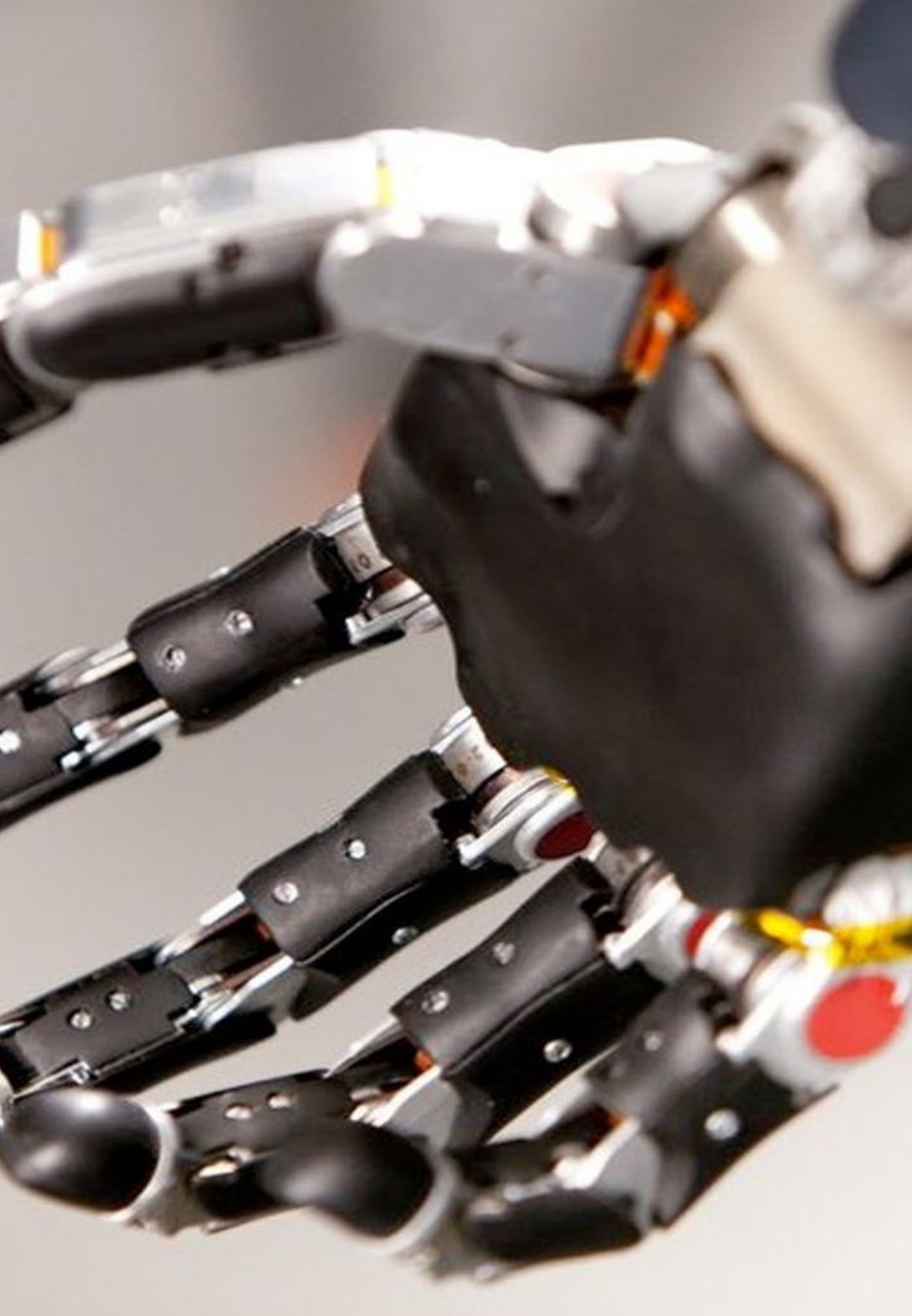
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A syllabus that will allow you to obtain the necessary knowledge in Biomedical Physics and will lead you to use it in the field of Engineering”

Module 1. Biophysics

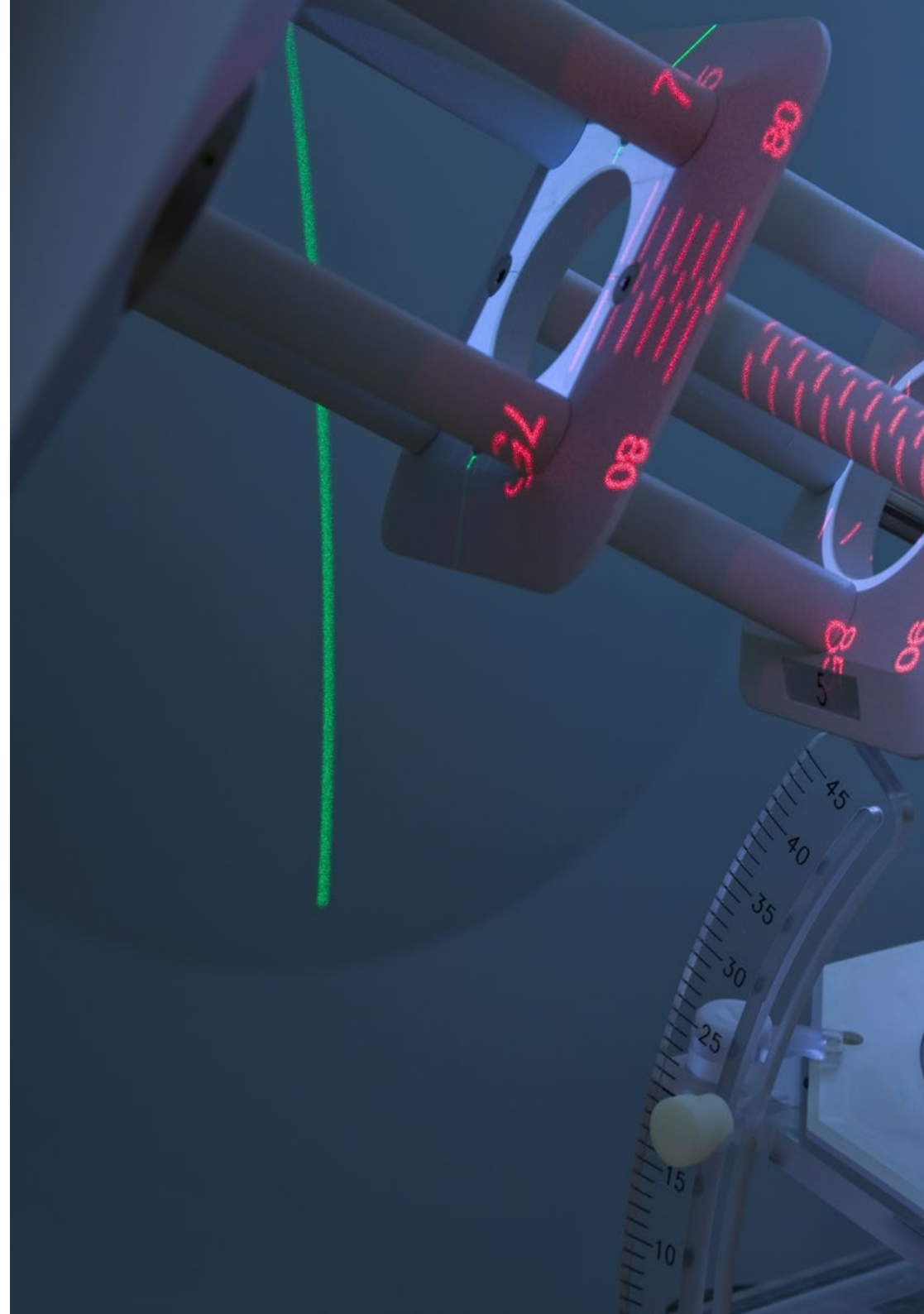
- 1.1. Introduction to Biophysics
 - 1.1.1. Introduction to Biophysics
 - 1.1.2. Characteristics of Biological Systems
 - 1.1.3. Molecular Biophysics
 - 1.1.4. Cell Biophysics
 - 1.1.5. Biophysics of Complex Systems
- 1.2. Introduction to the Thermodynamics of Irreversible Processes
 - 1.2.1. Generalization of the Second Principle of Thermodynamics for Open Systems
 - 1.2.2. Dissipation Function
 - 1.2.3. Linear Relationships between Conjugate Thermodynamic Fluxes and Forces
 - 1.2.4. Validity Interval of the Linear Thermodynamics
 - 1.2.5. Properties of Phenomenological Coefficients
 - 1.2.6. Onsager's Relations
 - 1.2.7. Theorem of Minimum Entropy Production
 - 1.2.8. Stability of Steady States in the Vicinity of Equilibrium. Stability Criteria
 - 1.2.9. Processes Far from Equilibrium
 - 1.2.10. Evolution Criteria
- 1.3. Ordering in Time: Irreversible Processes away from Equilibrium
 - 1.3.1. Kinetic Processes Considered as Differential Equations
 - 1.3.2. Stationary Solutions
 - 1.3.3. Lotka-Volterra Model
 - 1.3.4. Stability of Stationary Solutions: perturbation method
 - 1.3.5. Trajectories: Solutions of the Systems of Differential Equations
 - 1.3.6. Types of Stability
 - 1.3.7. Analysis of the Stability in the Lotka-Volterra Model
 - 1.3.8. Timing: Biological Clocks
 - 1.3.9. Structural Stability and Bifurcations. Brusselator's Model
 - 1.3.10. Classification of the Different Types of Dynamic Behavior
- 1.4. Spatial Arrangement: Systems with Diffusion
 - 1.4.1. Spatial-Temporal Self-Organization
 - 1.4.2. Reaction-Diffusion Equations
 - 1.4.3. Solutions of These Equations
 - 1.4.4. Examples:
- 1.5. Chaos in Biological Systems
 - 1.5.1. Introduction
 - 1.5.2. Attractors. Strange or Chaotic Attractors
 - 1.5.3. Definition and Properties of Chaos
 - 1.5.4. Ubiquity: Chaos in Biological Systems
 - 1.5.5. Universality: Routes to Chaos
 - 1.5.6. Fractal Structure Fractals
 - 1.5.7. Fractal Properties
 - 1.5.8. Reflections on Chaos in Biological Systems
- 1.6. Membrane Potential Biophysics
 - 1.6.1. Introduction
 - 1.6.2. First Approach to the Membrane Potential: Nernst Potential
 - 1.6.3. Gibbs-Donnan Potentials
 - 1.6.4. Surface Potentials
- 1.7. Transport across Membranes: Passive Transport
 - 1.7.1. Nernst-Planck Equation
 - 1.7.2. Constant Field Theory
 - 1.7.3. GHK Equation in Complex Systems
 - 1.7.4. Fixed Charge Theory
 - 1.7.5. Action Potential Transmission
 - 1.7.6. TPI Transport Analysis
 - 1.7.7. Electrokinetic Phenomena
- 1.8. Facilitated Transport. Ion Channels Transporters
 - 1.8.1. Introduction
 - 1.8.2. Characteristics of Transport Facilitated by Transporters and Ion Channels
 - 1.8.3. Model of Oxygen Transport with Hemoglobin Thermodynamics of Irreversible Processes
 - 1.8.4. Examples:
- 1.9. Active Transport: Effect of Chemical Reactions on Transport Processes
 - 1.9.1. Chemical Reactions and Steady State Concentration Gradients
 - 1.9.2. Phenomenological Description of Active Transport
 - 1.9.3. The Sodium-Potassium Pump
 - 1.9.4. Oxidative Phosphorylation

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- 1.10. Nervous Impulses
 - 1.10.1. Phenomenology of the Action Potential
 - 1.10.2. Mechanism of the Action Potential
 - 1.10.3. Hodgkin-Huxley Mechanism
 - 1.10.4. Nerves, Muscles and Synapses

Module 2. Medical Physics

- 2.1. Natural and Artificial Radiation Sources
 - 2.1.1. Alpha, Beta and Gamma Emitting Nuclei
 - 2.1.2. Nuclear Reactions
 - 2.1.3. Neutron Sources
 - 2.1.4. Charged Particle Accelerators
 - 2.1.5. X-Ray Generators
- 2.2. Radiation-Matter Interaction
 - 2.2.1. Photon Interactions (Rayleigh and Compton Scattering, Photoelectric Effect, and Electron-Positron Pair Creation)
 - 2.2.2. Electron-Positron Interactions (Elastic and Inelastic Collisions, Emission of Braking Radiation or Bremsstrahlung and Positron Annihilation)
 - 2.2.3. Ion Interactions
 - 2.2.4. Neutron Interactions
- 2.3. Monte Carlo Simulation of Radiation Transport
 - 2.3.1. Pseudorandom Number Generation
 - 2.3.2. Random Number Drawing Techniques
 - 2.3.3. Radiation Transport Simulation
 - 2.3.4. Practical Examples
- 2.4. Dosimetry
 - 2.4.1. Dosimetric Quantities and Units (ICRU)
 - 2.4.2. External Exposure
 - 2.4.3. Radionuclides Incorporated in the Organism
 - 2.4.4. Radiation-Matter Interaction
 - 2.4.5. Radiological Protection
 - 2.4.6. Permitted Limits for the Public and Professionals

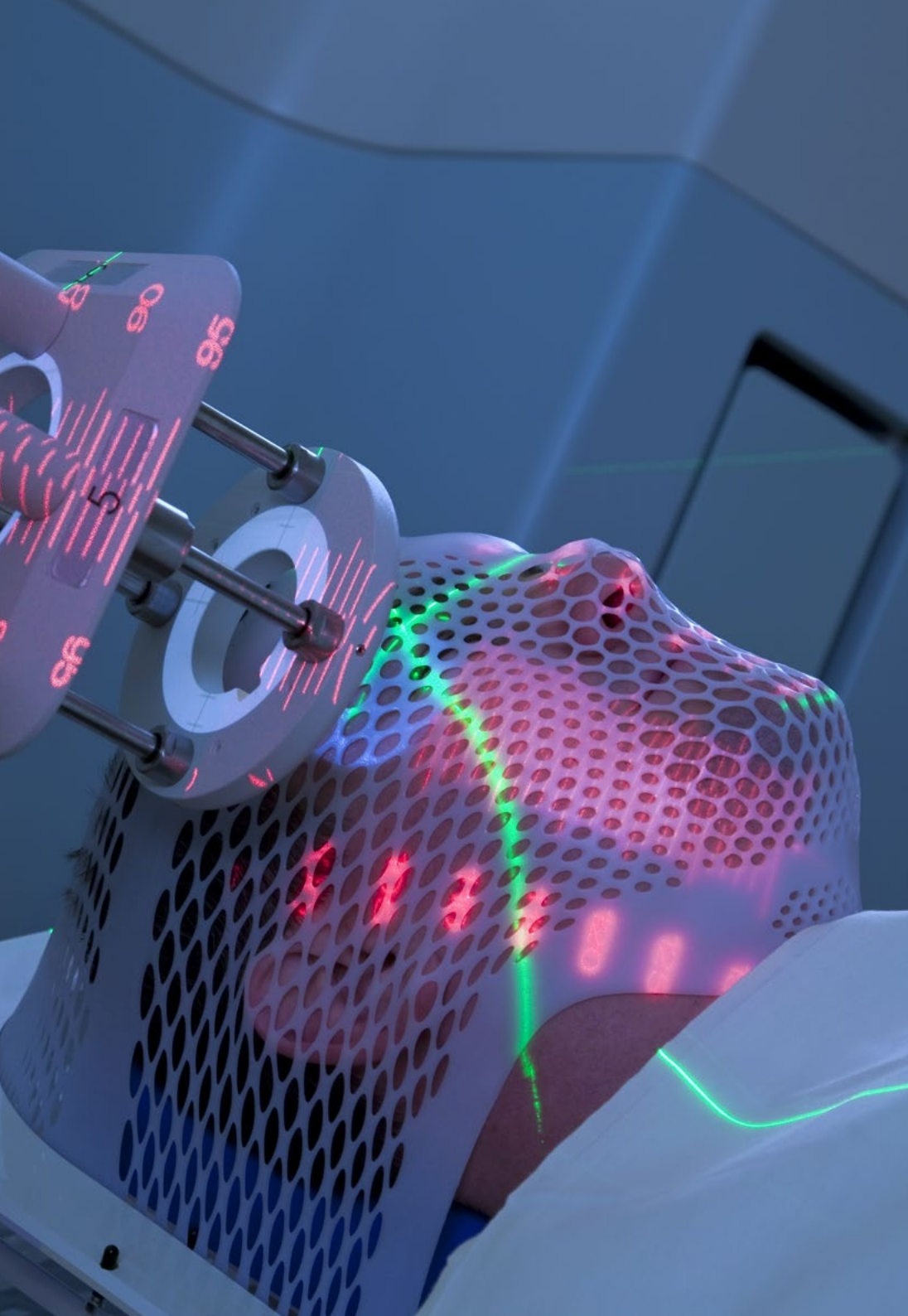
- 2.5. Radiobiology and Radiotherapy
 - 2.5.1. Radiobiology
 - 2.5.2. External Radiation Therapy with Photons and Electrons
 - 2.5.3. Brachytherapy
 - 2.5.4. Advanced Processing Methods (Ions and Neutrons)
 - 2.5.5. Planning
- 2.6. Biomedical Images
 - 2.6.1. Biomedical Imaging Techniques
 - 2.6.2. Image Enhancement using Histogram Modification
 - 2.6.3. Fourier Transform
 - 2.6.4. Filtering
 - 2.6.5. Restoration
- 2.7. Nuclear medicine
 - 2.7.1. Tracers
 - 2.7.2. Detector Equipment
 - 2.7.3. Gamma Camera
 - 2.7.4. Planar Scintigraphy
 - 2.7.5. SPECT
 - 2.7.6. PET:
 - 2.7.7. Small Animal Equipment
- 2.8. Reconstruction Algorithms
 - 2.8.1. Radon Transform
 - 2.8.2. Central Section Theorem
 - 2.8.3. Filtering Back Projection Algorithm
 - 2.8.4. Noise Filtering
 - 2.8.5. Iterative Reconstruction Algorithms
 - 2.8.6. Algebraic Algorithm (ART)
 - 2.8.7. Maximum Likelihood Estimation (MLE)
 - 2.8.8. Ordered Subsites (OSEM)



- 2.9. Biomedical Image Reconstruction
 - 2.9.1. SPECT Reconstruction
 - 2.9.2. Degrading Effects Associated with Photon Attenuation, Scattering, System Response, and Noise
 - 2.9.3. Compensation in the Filtered Back Projection Algorithm
 - 2.9.4. Compensation in Iterative Methods
- 2.10. Radiology and Magnetic Resonance Imaging (MRI)
 - 2.10.1. Imaging Techniques in Radiology: Radiography and CT
 - 2.10.2. Introduction to MRI
 - 2.10.3. MRI Imaging
 - 2.10.4. MRI Spectroscopy
 - 2.10.5. Quality Control

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Thanks to this program you will get up to date with the different applications of nuclear medicine”

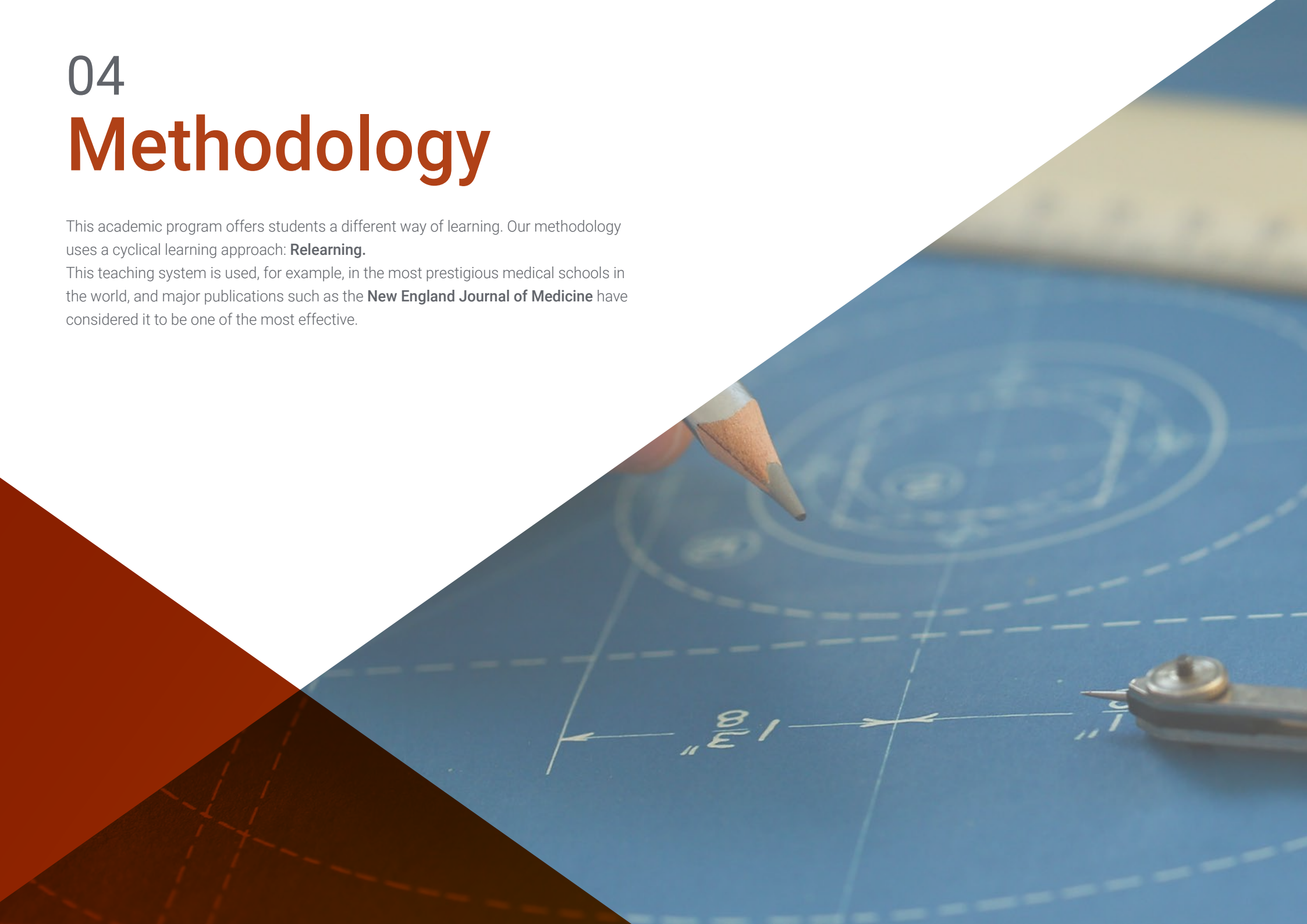


04

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.





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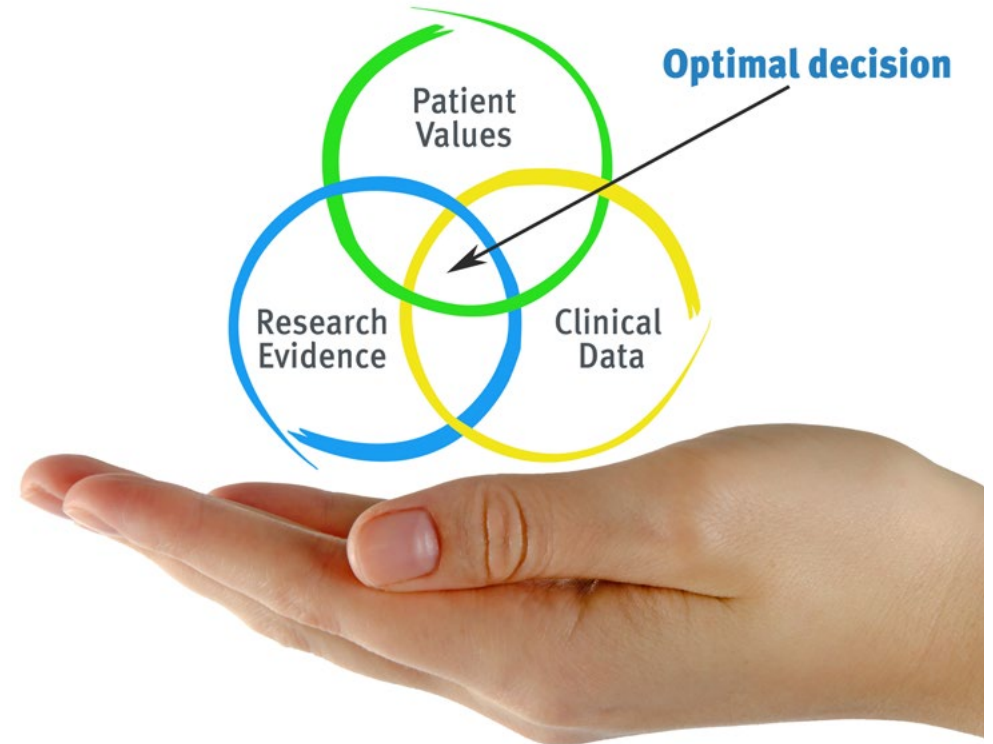
Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

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.



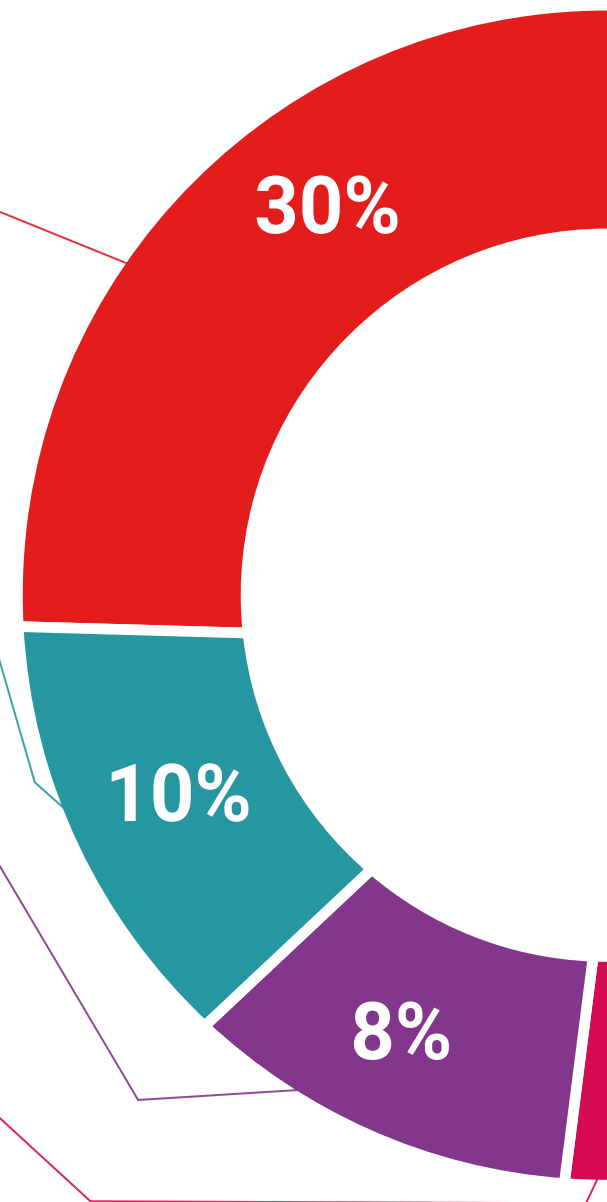
Practising Skills and Abilities

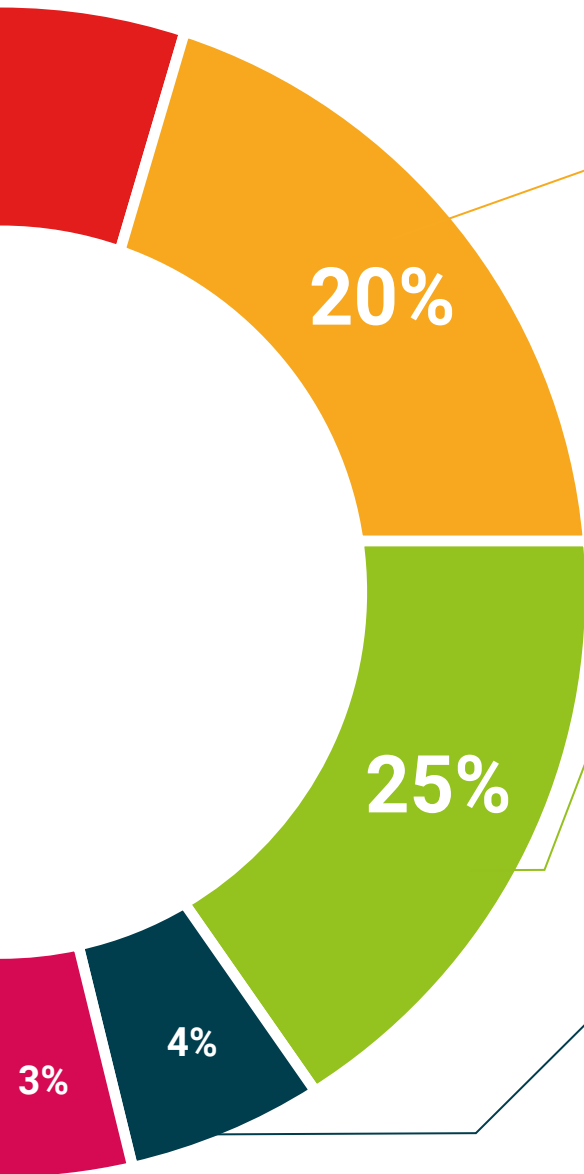
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



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

The Postgraduate Certificate in Biomedical Physics guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Technological University.



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

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

After the students have passed the assessments, they will receive their corresponding **Postgraduate Certificate** issued by **TECH Technological University** via tracked delivery*.

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

Title: **Postgraduate Certificate in Biomedical Physics**

Official N°. of Hours: **300 h.**



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

future
health confidence people
education information tutors
guarantee accreditation teaching
institutions technology learning
community commitment
personalized service innovation
knowledge present
development language
virtual classroom



Postgraduate Certificate Biomedical Physics

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

Postgraduate Certificate Biomedical Physics

