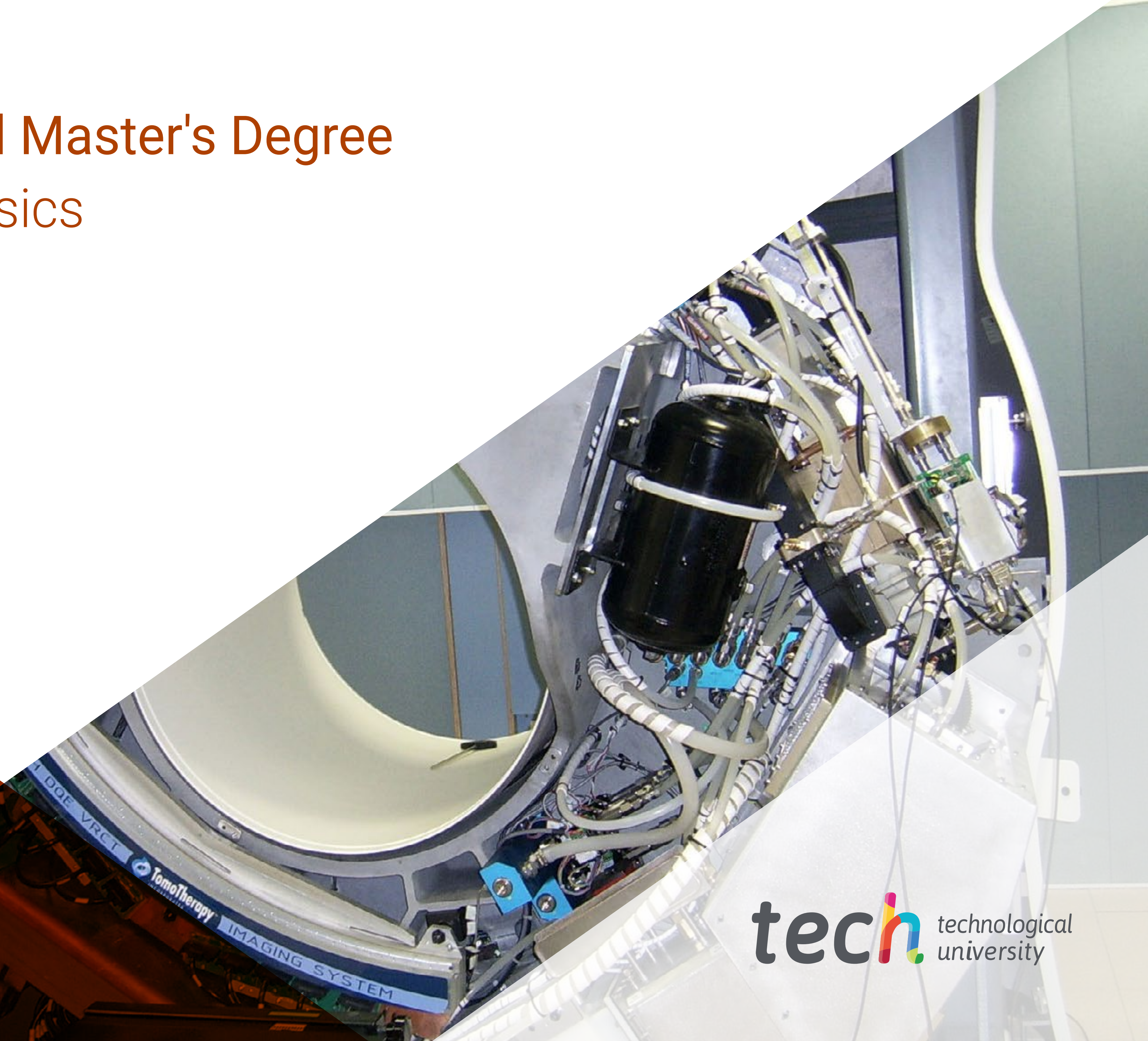
Professional Master's Degree
Medical Physics



tech technological university

Professional Master's Degree
Medical Physics

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Technological University**
- Dedication: **8h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/in/engineering/professional-master-degree/master-medical-physics**

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01 Introduction

Scientific studies and technical advances in recent decades have enhanced the prevention, diagnosis and treatment of diseases through medical physics. This knowledge has a direct impact on human welfare and requires highly qualified specialists to contribute to the analysis of environmental radiological quality or the improvement of proton radiation therapy. Faced with this reality, this academic institution has developed a 100% online program, which allows the graduate to delve deeper into modern physics, biophysics or remote sensing and image processing. All of this, in addition to innovative multimedia content that can be accessed 24 hours a day from any device with an Internet connection.

A university program that will provide you with solid learning about physics and its direct application in the healthcare field. Take the step and sign up now"

Undoubtedly, technological advances have made it possible to transfer the knowledge and concepts of physics to reality. The contribution of engineering, in this sense, has been key to the current availability of devices that, in the healthcare field, facilitate the prevention, detection and treatment of certain diseases.

Therefore, significant progress has been made in radiation treatments (radiography, tomography, gammagraphy), equipment or the design of the facilities to be able to apply these therapies. Likewise, scientific groups have managed to go beyond a hospital center, to promote the modeling and development of vaccines or the creation of new drugs. Undoubtedly, the contribution of engineering professionals is a determining factor in achieving progress in this field. For this reason, TECH has designed this 100% online program, where the student will be able to obtain a solid learning about Medical Physics.

To this end, this academic institution provides the most innovative pedagogical tools. Thanks to them, students will be able to learn in a much more dynamic way about biophysics, the key concepts of optics or advanced thermodynamics. In addition, through a theoretical-practical approach, the professional will learn about remote sensing and image processing, the most commonly used computer programs and modern physics.

A university education taught exclusively online, without classes with fixed schedules and which the professional can access whenever and wherever they wish. All you need is an electronic device (computer, tablet or cell phone) with Internet connection to view all the syllabus on the Virtual Campus. In addition, students have the freedom to distribute the teaching load according to their needs. This program is, therefore, an excellent opportunity to progress professionally in Medical Physics through a Professional Master's Degree, which is at the academic forefront.

This **Professional Master's Degree 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 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

Enroll now in a100% online Professional Master's Degree that allows you to combine your professional responsibilities with a quality education"

Do you want to be the next engineering professional innovating in the field of Medical Physics? With this Professional Master's Degree, you will gain the knowledge you need. Enroll now"

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.

You have video summaries of each topic, videos in detail or essential readings with which you can acquire the most advanced knowledge in Medical Physics.

Delve into the physical processes in daily life and medical applications whenever you wish via your computer or tablet.

02
Objectives

The syllabus of this Professional Master's Degree has been designed with the aim of providing the most advanced and comprehensive knowledge on Medical Physics and therefore boosting the graduate's professional career. Upon completing this program, students will learn about new developments and advances in the field of theoretical and experimental physics, nuclear and particle physics or apply the concepts of thermodynamics. For this purpose, it also has specialists in the field who will answer any questions you may have about the syllabus.

An educational program with a theoretical and practical approach that will lead you to master Feynman diagrams or thermodynamics"

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

With this program, you will be up to date with the latest advances in Medical Physics and its application in treating diseases"

Specific Objectives

Module 1. Chemistry
- Explain, in an understandable way, basic chemical phenomena and processes that interact with the environment
- Describe the structure, physicochemical properties and reactivity of elements and compounds involved in biogeochemical cycles
- Operate basic instrumentation in a chemistry laboratory
- Have the ability to interpret the results in the practical environment of chemistry

Module 2. Introduction to Modern Physics
- Identify and assess the presence of physical processes in daily life and in both specific (medical applications, fluid behavior, optics or radiation protection) and common scenarios (electromagnetism, thermodynamics or classical mechanics)
- Be able to use computer tools to solve and model physical problems
- Be familiar with new developments and advances in the field of physics, both theoretical and experimental
- Develop communication skills, to write reports and documents, or to make effective presentations of these

Module 3. Optics
- Learn in-depth the basic knowledge of geometrical optics
- Know the physical principles on which the most common optical instruments are based
- Understand and analyze optical phenomena present in daily life
- Apply the concepts of optics to solve physical problems related to optics and understand the relationship between optics and other disciplines of physics

Module 4. Thermodynamics

- Solve problems effectively in the field of thermodynamics
- Acquire basic notions of statistical mechanics
- Be able to analyze different contexts and environments in the field of physics based on a solid mathematical foundation
- Understand and use mathematical and numerical methods commonly used in thermodynamics

Module 5. Advanced Thermodynamics

- Advance in the principles of thermodynamics
- Understand the concepts of collectivity and be able to differentiate between the different types
- Know how to distinguish which collectivity will be more useful to the study of a given system depending on the type of thermodynamic system
- Know the basics of the Ising model
- Gain knowledge of the difference between boson and baryon statistics

Module 6. Nuclear and Particle Physics

- Obtain basic knowledge of nuclear and particle physics
- Know how to distinguish the different nuclear decay processes
- Know the Feynman diagrams, their use and how to draw them
- Know how to calculate relativistic collisions

Module 7. Fluid Mechanics

- Understand the general concepts of Fluid Physics and solve related problems
- Know the basic characteristics of fluids and their behaviors under various conditions
- Know the constitutive equations
- Acquire confidence in the handling of the Navier-Stokes equations

Module 8. 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 9. Biophysics

- Know the characteristics of 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 10. 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

Skills

Thanks to this university program, students will be able to broaden their skills in the field of Medical Physics. In addition, you will acquire skills in this field that will allow you to master the software used in remote sensing, apply bipolar digital circuits and advanced technology or be able to accurately identify the effects of ionizing radiation on people. The case studies provided in this program will be very useful in achieving these goals.

The Relearning system used by TECH will help you acquire a much more agile learning and reduce the long hours of study"

General Skills

- Know how to apply 3D and 4D segmentation and processing techniques
- Apply advanced processing methods (ions and neutrons)
- Recognize the effects of chemical reactions on transport processes
- Master imaging techniques in radiology: radiography and CT

> *Click and enroll in a university program that will allow you to master the main software used in Remote Sensing"*

Specific Skills

- Understand the principles of radiation protection and the quantities and units used in radiation protection systems
- Detect the effects of ionizing radiation on living beings
- Be able to apply bipolar and advanced technology digital circuits
- Proper use of Remote Sensing software with Python

04
Structure and Content

The effectiveness of the Relearning system, based on the reiteration of content, has led TECH to use it in each of its programs, which allows students to advance through the syllabus in a much more agile way and even reduce the long hours of study. The engineering professional will therefore progress through the most comprehensive content on Medical Physics. In addition, there are video summaries of each topic, detailed videos and specialized readings that will allow you to delve into biophysics, nuclear physics and particle physics, as well as the main software used in remote sensing and image processing.

A syllabus that will take you through twelve months of the most advanced and current knowledge on Medical Physics"

Module 1. Chemistry

1.1. Matter Structure and Chemical Bonding
 1.1.1. Matter
 1.1.2. The Atom
 1.1.3. Types of Chemical Bonds
1.2. Gases, Liquids and Solutions
 1.2.1. Gases
 1.2.2. Liquids
 1.2.3. Types of Solutions
1.3. Thermodynamics
 1.3.1. Introduction to Thermodynamics
 1.3.2. First Principle of Thermodynamics
 1.3.3. Second Principle of Thermodynamics
1.4. Acid-Base
 1.4.1. Concepts of Acidity and Basicity
 1.4.2. PH
 1.4.3. pOH
1.5. Solubility and Precipitation
 1.5.1. Solubility Equilibrium
 1.5.2. Floccules
 1.5.3. Colloids
1.6. Oxidation-Reduction Reaction
 1.6.1. Redox Potential
 1.6.2. Introduction to Batteries
 1.6.3. Electrolytic Tank
1.7. Carbon Chemistry
 1.7.1. Introduction
 1.7.2. Carbon Cycle
 1.7.3. Organic Formulation
1.8. Energy and Environment
 1.8.1. Battery Continuation
 1.8.2. Carnot Cycle
 1.8.3. Diesel Cycle
1.9. Atmospheric Chemistry
 1.9.1. Main Atmospheric Pollutants
 1.9.2. Acid Rain
 1.9.3. Transboundary Pollution
1.10. Soil and Water Chemistry
 1.10.1. Introduction
 1.10.2. Water Chemistry
 1.10.3. Soil Chemistry

Module 2. Introduction to Modern Physics

2.1. Introduction to Medical Physics
 2.1.1. How to Apply Physics to Medicine
 2.1.2. Energy of Charged Particles in Tissues
 2.1.3. Photons through Tissues
 2.1.4. Applications
2.2. Introduction to Particle Physics
 2.2.1. Introduction and Objectives
 2.2.2. Quantified Particles
 2.2.3. Fundamental Forces and Charges
 2.2.4. Particle Detection
 2.2.5. Classification of Fundamental Particles and Standard Model
 2.2.6. Beyond the Standard Model
 2.2.7. Current Generalization Theories
 2.2.8. High Energy Experiments
2.3. Particle Accelerators
 2.3.1. Particle Acceleration Processes
 2.3.2. Linear Accelerators
 2.3.3. Cyclotrons
 2.3.4. Synchrotrons
2.4. Introduction to Nuclear Physics
 2.4.1. Nuclear Stability
 2.4.2. New Methods in Nuclear Fission
 2.4.3. Nuclear Fusion
 2.4.4. Synthesis of Superheavy Elements

2.5. Introduction to Astrophysics
- 2.5.1. The Solar System
- 2.5.2. Birth and Death of a Star
- 2.5.3. Space Exploration
- 2.5.4. Exoplanets

2.6. Introduction to Cosmology
- 2.6.1. Distance Calculation in Astronomy
- 2.6.2. Velocity Calculations in Astronomy
- 2.6.3. Dark Matter and Energy
- 2.6.4. The Expansion of the Universe
- 2.6.5. Gravitational Waves

2.7. Geophysics and Atmospheric Physics
- 2.7.1. Geophysics
- 2.7.2. Atmospheric Physics
- 2.7.3. Meteorology
- 2.7.4. Climate Change

2.8. Introduction to Condensed Matter Physics
- 2.8.1. Aggregate States of Matter
- 2.8.2. Matter Allotropes
- 2.8.3. Crystalline Solids
- 2.8.4. Soft Matter

2.9. Introduction to Quantum Computing
- 2.9.1. Introduction to the Quantum World
- 2.9.2. Qubits
- 2.9.3. Multiple Qubits
- 2.9.4. Logic Gates
- 2.9.5. Quantum Programs
- 2.9.6. Quantum Computers

2.10. Introduction to Quantum Cryptography
- 2.10.1. Classic Information
- 2.10.2. Quantum Information
- 2.10.3. Quantum Encryption
- 2.10.4. Protocols in Quantum Cryptography

Module 3. Optics

3.1. Waves: Introduction
- 3.1.1. Wave Motion Equation
- 3.1.2. Plane Waves
- 3.1.3. Spherical Waves
- 3.1.4. Harmonic Solution of the Wave Equation
- 3.1.5. Fourier Analysis

3.2. Wavelet Superposition
- 3.2.1. Superposition of Waves of the Same Frequency
- 3.2.2. Superposition of Waves of Different Frequency
- 3.2.3. Phase Velocity and Group Velocity
- 3.2.4. Superposition of Waves with Perpendicular Electric Vectors

3.3. Electromagnetic Theory of Light
- 3.3.1. Maxwell's Macroscopic Equations
- 3.3.2. The Material Response
- 3.3.3. Energy Relations
- 3.3.4. Electromagnetic Waves
- 3.3.5. Homogeneous and Isotropic Linear Medium
- 3.3.6. Transversality of Plane Waves
- 3.3.7. Energy Transport

3.4. Isotropic Media
- 3.4.1. Reflection and Refraction in Dielectrics
- 3.4.2. Fresnel Formulas
- 3.4.3. Dielectric Media
- 3.4.4. Induced Polarization
- 3.4.5. Classical Lorentz Dipole Model
- 3.4.6. Propagation and Diffusion of a Light Beam

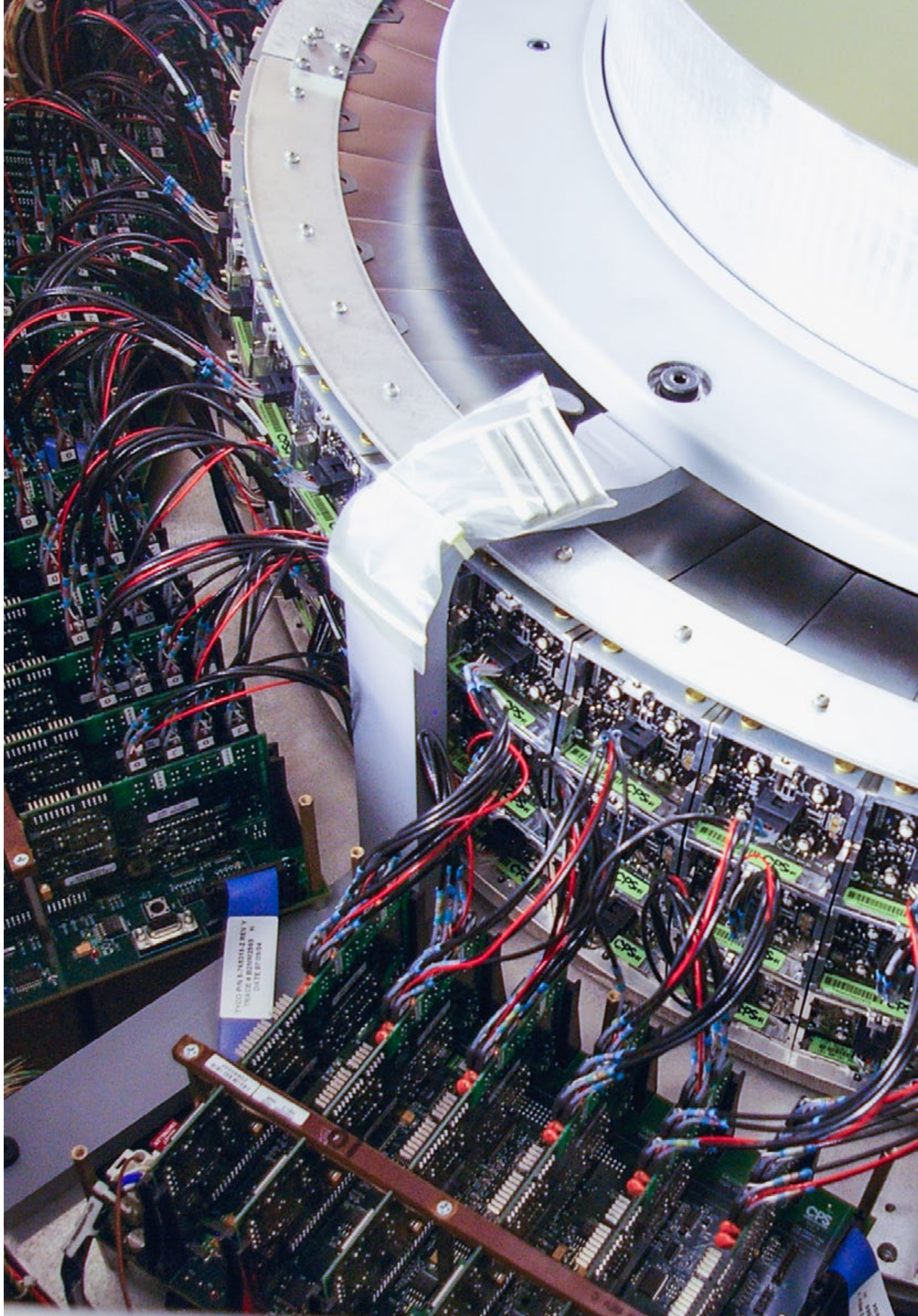
3.5. Geometric Optics
- 3.5.1. Paraxial Approximation
- 3.5.2. Fermat's Principle
- 3.5.3. Trajectory Equation
- 3.5.4. Propagation in Non-Uniform Media

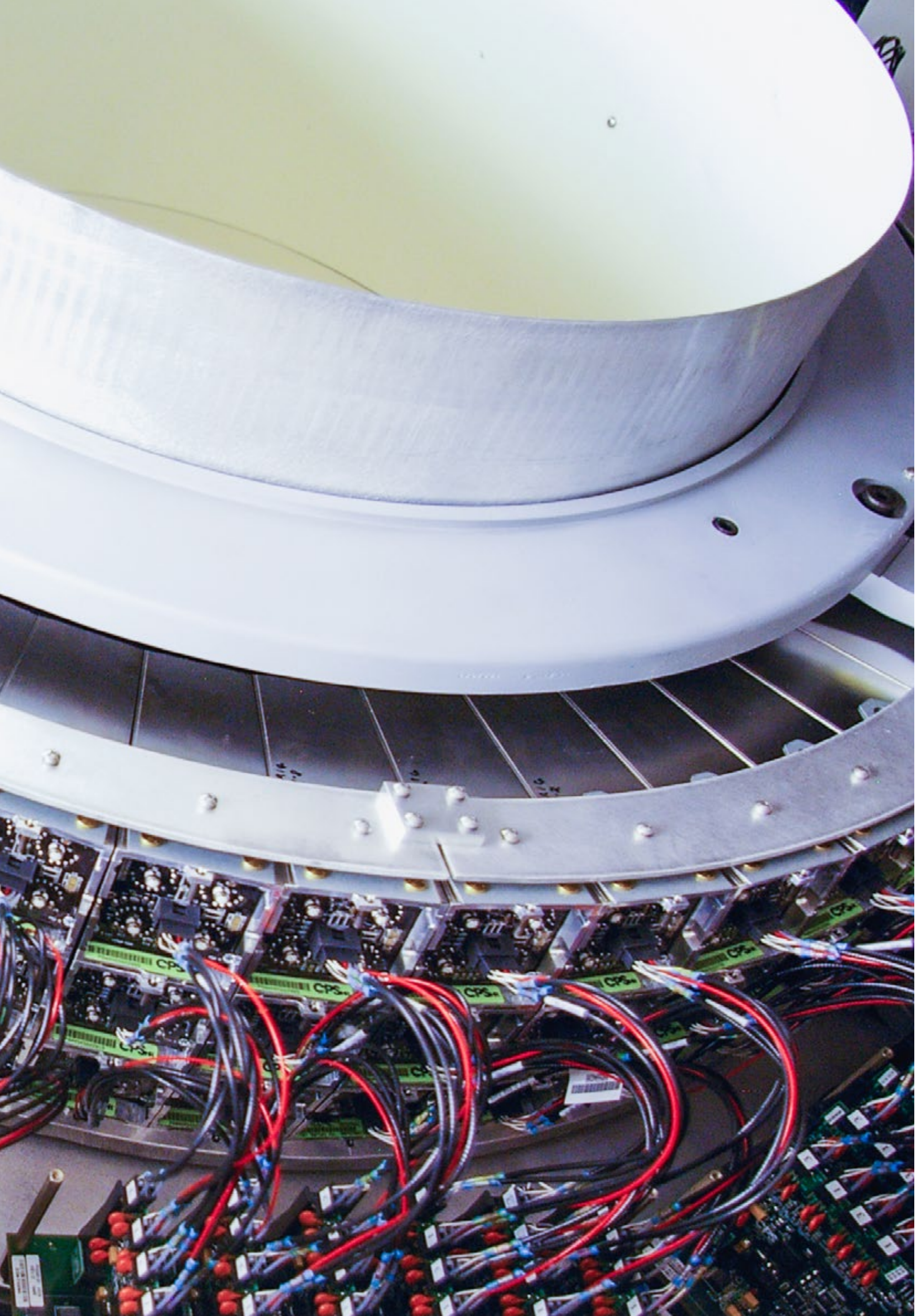
3.6. Image Formation
- 3.6.1. Image Formation in Geometrical Optics
- 3.6.2. Paraxial Optics
- 3.6.3. Abbe's Invariant
- 3.6.4. Increases
- 3.6.5. Centered Systems
- 3.6.6. Focuses and Focal Planes
- 3.6.7. Planes and Main Points
- 3.6.8. Thin Lenses
- 3.6.9. System Coupling

3.7. Optical Instruments
- 3.7.1. The Human Eye
- 3.7.2. Photographic and Projection Instruments
- 3.7.3. Telescopes
- 3.7.4. Near Vision Instruments: Compound Magnifier and Microscope

3.8. Anisotropic Media
- 3.8.1. Polarization
- 3.8.2. Electrical Susceptibility Index Ellipsoid
- 3.8.3. Wave Equation in Anisotropic Media
- 3.8.4. Propagation Conditions
- 3.8.5. Refraction in Anisotropic Media
- 3.8.6. Fresnel Construction
- 3.8.7. Construction with the Index Ellipsoid
- 3.8.8. Retarders
- 3.8.9. Absorbent Anisotropic Media

3.9. Interference
- 3.9.1. General Principles and Interference Conditions
- 3.9.2. Wavefront Split Interference
- 3.9.3. Young's Stripes
- 3.9.4. Amplitude Division Interferences
- 3.9.5. Michelson's Interferometer
- 3.9.6. Interference of Multiple Beams Obtained by Amplitude Division
- 3.9.7. Fabry-Perot's Interferometer





3.10. Diffraction
- 3.10.1. The Huygens-Fresnel Principle
- 3.10.2. Fresnel and Fraunhofer Diffraction
- 3.10.3. Fraunhofer's Diffraction through an Aperture
- 3.10.4. Limitation of the Resolutive Power of the Instruments
- 3.10.5. Fraunhofer Diffraction by Various Apertures
- 3.10.6. Double Slit
- 3.10.7. Diffraction Grating
- 3.10.8. Introduction to Kirchhoff's Scalar Theory

Module 4. Thermodynamics

4.1. Mathematical Tools: Review
- 4.1.1. Review of the Logarithm and Exponential Functions
- 4.1.2. Review of Derivatives
- 4.1.3. Integrals
- 4.1.4. Derivative of a Function of Several Variables

4.2. Calorimetry. Zero Principle in Thermodynamics
- 4.2.1. Introduction and General Concepts
- 4.2.2. Thermodynamic Systems
- 4.2.3. Zero Principle in Thermodynamics
- 4.2.4. Temperature Scales. Absolute Temperature
- 4.2.5. Reversible and Irreversible Processes
- 4.2.6. Sign Criteria
- 4.2.7. Specific Heat
- 4.2.8. Molar Heat
- 4.2.9. Phase Changes
- 4.2.10. Thermodynamic Coefficients

4.3. Thermodynamic Work. First Principle of Thermodynamics
- 4.3.1. Heat and Thermodynamic Work
- 4.3.2. State Functions and Internal Energy
- 4.3.3. First Principle of Thermodynamics
- 4.3.4. Work of a Gas System
- 4.3.5. Joule's Law
- 4.3.6. Heat of Reaction and Enthalpy

4.4. Ideal Gases
- 4.4.1. Ideal Gas Laws
  - 4.4.1.1. Boyle-Mariotte's Law
  - 4.4.1.2. Charles and Gay-Lussac's Laws
  - 4.4.1.3. Equation of State of Ideal Gases
    - 4.4.1.3.1. Dalton's Law
    - 4.4.1.3.2. Mayer's Law
- 4.4.2. Calorimetric Equations of the Ideal Gas
- 4.4.3. Adiabatic Processes
  - 4.4.3.1. Adiabatic Transformations of an Ideal Gas
    - 4.4.3.1.1. Relationship between Isotherms and Adiabatics
    - 4.4.3.1.2. Work in Adiabatic Processes
- 4.4.4. Polytropic Transformations

4.5. Real Gases
- 4.5.1. Motivation
- 4.5.2. Ideal and Real Gases
- 4.5.3. Description of Real Gases
- 4.5.4. Equations of State of Series Development
- 4.5.5. Van der Waals Equation and Series Development
- 4.5.6. Andrews Isotherms
- 4.5.7. Metastable States
- 4.5.8. Van der Waals Equation: Consequences

4.6. Entropy
- 4.6.1. Introduction and Objectives
- 4.6.2. Entropy: Definition and Units
- 4.6.3. Entropy of an Ideal Gas
- 4.6.4. Entropic Diagram
- 4.6.5. Clausius Inequality
- 4.6.6. Fundamental Equation of Thermodynamics
- 4.6.7. Carathéodory's Theorem

4.7. Second Principle of Thermodynamics
- 4.7.1. Second Principle of Thermodynamics
- 4.7.2. Transformations between Two Thermal Focuses
- 4.7.3. Carnot Cycle
- 4.7.4. Real Thermal Machines
- 4.7.5. Clausius Theorem

4.8. Thermodynamic Functions. Third Principle of Thermodynamics
- 4.8.1. Thermodynamic Functions
- 4.8.2. Thermodynamic Equilibrium Conditions
- 4.8.3. Maxwell's Equations
- 4.8.4. Thermodynamic Equation of State
- 4.8.5. Internal Energy of a Gas
- 4.8.6. Adiabatic Transformations in a Real Gas
- 4.8.7. Third Principle of Thermodynamics and Consequences

4.9. Kinetic-Molecular Theory of Gases
- 4.9.1. Hypothesis of the Kinetic-Molecular Theory
- 4.9.2. Kinetic Theory of the Pressure of a Gas
- 4.9.3. Adiabatic Evolution of a Gas
- 4.9.4. Kinetic Theory of Temperature
- 4.9.5. Mechanical Argument for Temperature
- 4.9.6. Principle of Equipartition of Energy
- 4.9.7. Virial Theorem

4.10. Introduction to Statistical Mechanics
- 4.10.1. Introduction and Objectives
- 4.10.2. General concepts
- 4.10.3. Entropy, Probability and Boltzmann's Law
- 4.10.4. Maxwell-Boltzmann Distribution Law
- 4.10.5. Thermodynamic and Partition Functions

Module 5. Advanced Thermodynamics

5.1. Formalism of Thermodynamics
- 5.1.1. Laws of Thermodynamics
- 5.1.2. The Fundamental Equation
- 5.1.3. Internal Energy: Euler's Form
- 5.1.4. Gibbs-Duhem Equation
- 5.1.5. Legendre Transformations
- 5.1.6. Thermodynamic Potentials
- 5.1.7. Maxwell's Relations for a Fluid
- 5.1.8. Stability Conditions

5.2. Microscopic Description of Macroscopic Systems I
- 5.2.1. Microstates and Macrostates: Introduction
- 5.2.2. Phase Space
- 5.2.3. Collectivities
- 5.2.4. Microcanonical Collectivity
- 5.2.5. Thermal Equilibrium

5.3. Microscopic Description of Macroscopic Systems II
- 5.3.1. Discrete Systems
- 5.3.2. Statistical Entropy
- 5.3.3. Maxwell-Boltzmann Distribution
- 5.3.4. Pressure
- 5.3.5. Effusion

5.4. Canonical Collectivity
- 5.4.1. Partition Function
- 5.4.2. Ideal Systems
- 5.4.3. Energy Degeneration
- 5.4.4. Behavior of the Monoatomic Ideal Gas at a Potential
- 5.4.5. Energy Equipartition Theorem
- 5.4.6. Discrete Systems

5.5. Magnetic Systems
- 5.5.1. Thermodynamics of Magnetic Systems
- 5.5.2. Classical Paramagnetism
- 5.5.3. ½Spin Paramagnetism
- 5.5.4. Adiabatic Demagnetization

5.6. Phase Transitions
- 5.6.1. Classification of Phase Transitions
- 5.6.2. Phase Diagrams
- 5.6.3. Clapeyron Equation
- 5.6.4. Vapor-Condensed Phase Equilibrium
- 5.6.5. The Critical Point
- 5.6.6. Ehrenfest's Classification of Phase Transitions
- 5.6.7. Landau's Theory

5.7. Ising's Model
- 5.7.1. Introduction
- 5.7.2. One-Dimensional Chain
- 5.7.3. Open One-Dimensional Chain
- 5.7.4. Mean Field Approximation

5.8. Real Gases
- 5.8.1. Comprehensibility Factor. Virial Development
- 5.8.2. Interaction Potential and Configurational Partition Function
- 5.8.3. Second Virial Coefficient
- 5.8.4. Van der Waals Equation
- 5.8.5. Lattice Gas
- 5.8.6. Corresponding States Law
- 5.8.7. Joule and Joule-Kelvin Expansions

5.9. Photon Gas
- 5.9.1. Boson Statistics Vs. Fermion Statistics
- 5.9.2. Energy Density and Degeneracy of States
- 5.9.3. Planck Distribution
- 5.9.4. Equations of State of a Photon Gas

5.10. Macrocanonical Collectivity
- 5.10.1. Partition Function
- 5.10.2. Discrete Systems
- 5.10.3. Fluctuations
- 5.10.4. Ideal Systems
- 5.10.5. The Monoatomic Gas
- 5.10.6. Vapor-Solid Equilibrium

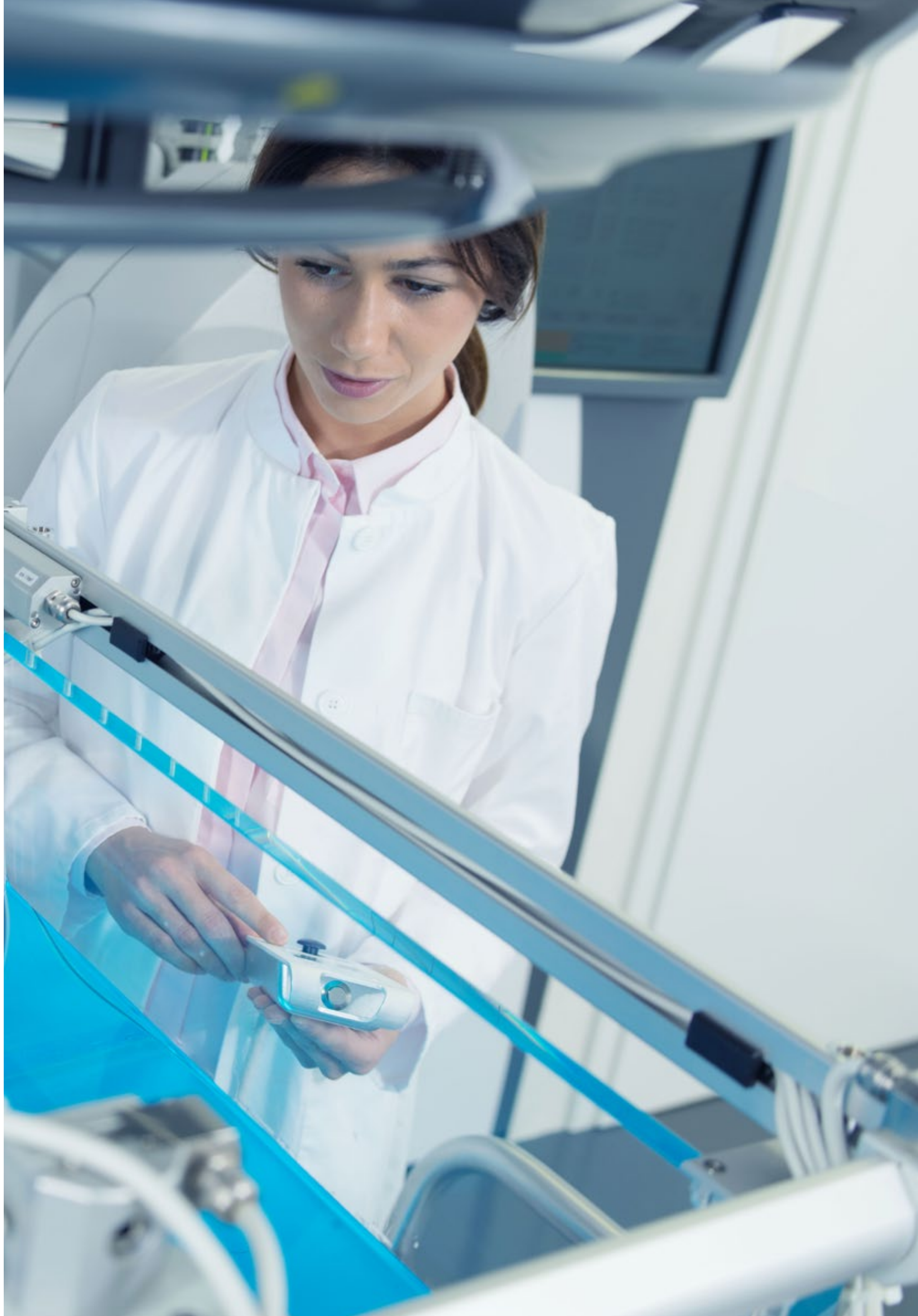
Module 6. Nuclear and Particle Physics

6.1. Introduction to Nuclear Physics
- 6.1.1. Periodic Table of the Elements
- 6.1.2. Important Discoveries
- 6.1.3. Atomic Models
- 6.1.4. Important Definitions Scales and Units in Nuclear Physics
- 6.1.5. Segré's Diagram

6.2. Nuclear Properties
- 6.2.1. Binding Energy
- 6.2.2. Semiempirical Mass Formula
- 6.2.3. Fermi Gas Model
- 6.2.4. Nuclear Stability
  - 6.2.4.1. Alpha Decay
  - 6.2.4.2. Beta Decay
  - 6.2.4.3. Nuclear Fusion
- 6.2.5. Nuclear Desexcitation
- 6.2.6. Double Beta Decay

6.3. Nuclear Scattering
- 6.3.1. Internal Structure: Dispersion Study
- 6.3.2. Effective Section
- 6.3.3. Rutherford's Experiment: Rutherford's Effective Section
- 6.3.4. Mott's Effective Section
- 6.3.5. Momentum Transfer and Shape Factors
- 6.3.6. Nuclear Charge Distribution
- 6.3.7. Neutron Scattering

6.4. Nuclear Structure and Strong Interaction
- 6.4.1. Nucleon Scattering
- 6.4.2. Bound States Deuterium
- 6.4.3. Strong Nuclear Interaction
- 6.4.4. Magic Numbers
- 6.4.5. The Layered Model of the Nucleus
- 6.4.6. Nuclear Spin and Parity
- 6.4.7. Electromagnetic Moments of the Nucleus
- 6.4.8. Collective Nuclear Excitations: Dipole Oscillations, Vibrational States and Rotational States



6.5. Nuclear Structure and Strong Interaction II
- 6.5.1. Classification of Nuclear Reactions
- 6.5.2. Reaction Kinematics
- 6.5.3. Conservation Laws
- 6.5.4. Nuclear Spectroscopy
- 6.5.5. The Compound Nucleus Model
- 6.5.6. Direct Reactions
- 6.5.7. Elastic Dispersion

6.6. Introduction to Particle Physics
- 6.6.1. Particles and Antiparticles
- 6.6.2. Fermions and Baryons
- 6.6.3. The Standard Model of Elementary Particles: Leptons and Quarks
- 6.6.4. The Quark Model
- 6.6.5. Intermediate Vector Bosons

6.7. Dynamics of Elementary Particles
- 6.7.1. The Four Fundamental Interactions
- 6.7.2. Quantum Electrodynamics
- 6.7.3. Quantum Chromodynamics
- 6.7.4. Weak Interaction
- 6.7.5. Disintegrations and Conservation Laws

6.8. Relativistic Kinematics
- 6.8.1. Lorentz Transformations
- 6.8.2. Quatrivectors
- 6.8.3. Energy and Linear Momentum
- 6.8.4. Collisions
- 6.8.5. Introduction to Feynman Diagrams

6.9. Symmetries
- 6.9.1. Groups, Symmetries and Conservation Laws
- 6.9.2. Spin and Angular Momentum
- 6.9.3. Addition of Angular Momentum
- 6.9.4. Flavor Symmetries
- 6.9.5. Parity
- 6.9.6. Load Conjugation
- 6.9.7. CP Violation
- 6.9.8. Time Reversal
- 6.9.9. CPT Conservation

6.10. Bound States
- 6.10.1. Schrödinger's Equation for Central Potentials
- 6.10.2. Hydrogen Atom
- 6.10.3. Fine Structure
- 6.10.4. Hyperfine Structure
- 6.10.5. Positronium
- 6.10.6. Quarkonium
- 6.10.7. Lightweight Mesons
- 6.10.8. Baryons

Module 7. Fluid Mechanics

7.1. Introduction to Fluid Physics
- 7.1.1. No-Slip Condition
- 7.1.2. Classification of Flows
- 7.1.3. Control System and Volume
- 7.1.4. Fluid Properties
  - 7.1.4.1. Density
  - 7.1.4.2. Specific Gravity
  - 7.1.4.3. Vapor Pressure
  - 7.1.4.4. Cavitation
  - 7.1.4.5. Specific Heat
  - 7.1.4.6. Compressibility
  - 7.1.4.7. Speed of Sound
  - 7.1.4.8. Viscosity
  - 7.1.4.9. Surface Tension

7.2. Fluid Statics and Kinematics
- 7.2.1. Pressure
- 7.2.2. Pressure Measuring Devices
- 7.2.3. Hydrostatic Forces on Submerged Surfaces

7.2.4. Buoyancy, Stability and Motion of Rigid Solids
7.2.5. Lagrangian and Eulerian Description
7.2.6. Flow Patterns
7.2.7. Kinematic Tensors
7.2.8. Vorticity
7.2.9. Rotationality
7.2.10. Reynolds Transport Theorem

7.3. Bernoulli and Energy Equations
7.3.1. Conservation of Mass
7.3.2. Mechanical Energy and Efficiency
7.3.3. Bernoulli's Equation
7.3.4. General Energy Equation
7.3.5. Stationary Flow Energy Analysis

7.4. Fluid Analysis
7.4.1. Conservation of Linear Momentum Equations
7.4.2. Conservation of Angular Momentum Equations
7.4.3. Dimensional Homogeneity
7.4.4. Variable Repetition Method
7.4.5. Buckingham's Pi Theorem

7.5. Flow in Pipes
7.5.1. Laminar and Turbulent Flow
7.5.2. Inlet Region
7.5.3. Minor Losses
7.5.4. Networks

7.6. Differential Analysis and Navier-Stokes Equations
7.6.1. Conservation of Mass
7.6.2. Current Function
7.6.3. Cauchy Equation
7.6.4. Navier-Stokes Equation
7.6.5. Dimensionless Navier-Stokes Equations of Motion
7.6.6. Stokes Flow
7.6.7. Inviscid Flow
7.6.8. Irrotational Flow
7.6.9. Boundary Layer Theory. Clausius Equation

7.7. External Flow
7.7.1. Drag and Lift
7.7.2. Friction and Pressure
7.7.3. Coefficients
7.7.4. Cylinders and Spheres
7.7.5. Aerodynamic Profiles

7.8. Compressible Flow
7.8.1. Stagnation Properties
7.8.2. One-Dimensional Isentropic Flow
7.8.3. Nozzles
7.8.4. Shock Waves
7.8.5. Expansion Waves
7.8.6. Rayleigh Flow
7.8.7. Fanno Flow

7.9. Open Channel Flow
7.9.1. Classification
7.9.2. Froude Number
7.9.3. Wave Speed
7.9.4. Uniform Flow
7.9.5. Gradually Varying Flow
7.9.6. Rapidly Varying Flow
7.9.7. Hydraulic Jump

7.10. Non-Newtonian Fluids
7.10.1. Standard Flows
7.10.2. Material Functions
7.10.3. Experiments
7.10.4. Generalized Newtonian Fluid Model
7.10.5. Generalized Linear Viscoelastic Fluid Model
7.10.6. Advanced Constitutive Equations and Geometry

Module 8. Remote Sensing and Image Processing

8.1. Introduction to Image Processing
- 8.1.1. Motivation
- 8.1.2. Digital Medical and Atmospheric Imaging
- 8.1.3. Modalities of Medical and Atmospheric Imaging
- 8.1.4. Quality Parameters
- 8.1.5. Storage and Display
- 8.1.6. Processing Platforms
- 8.1.7. Image Processing Applications

8.2. Image Optimization, Registration and Fusion
- 8.2.1. Introduction and Objectives
- 8.2.2. Intensity Transformations
- 8.2.3. Noise Correction
- 8.2.4. Filters in the Spatial Domain
- 8.2.5. Frequency Domain Filters
- 8.2.6. Introduction and Objectives
- 8.2.7. Geometric Transformations
- 8.2.8. Records
- 8.2.9. Multimodal Merging
- 8.2.10. Applications of Multimodal Fusion

8.3. 3D and 4D Segmentation and Processing Techniques
- 8.3.1. Introduction and Objectives
- 8.3.2. Segmentation Techniques
- 8.3.3. Morphological Operations
- 8.3.4. Introduction and Objectives
- 8.3.5. Morphological and Functional Imaging
- 8.3.6. 3D Analysis
- 8.3.7. 4D Analysis

8.4. Feature Extraction
- 8.4.1. Introduction and Objectives
- 8.4.2. Texture Analysis
- 8.4.3. Morphometric Analysis
- 8.4.4. Statistics and Classification
- 8.4.5. Presentation of Results

8.5. Machine Learning
- 8.5.1. Introduction and Objectives
- 8.5.2. Big Data
- 8.5.3. Deep Learning
- 8.5.4. Software Tools
- 8.5.5. Applications
- 8.5.6. Limitations

8.6. Introduction to Remote Sensing
- 8.6.1. Introduction and Objectives
- 8.6.2. Definition of Remote Sensing
- 8.6.3. Exchange Particles in Remote Sensing
- 8.6.4. Active and Passive Remote Sensing
- 8.6.5. Remote Sensing Software with Python

8.7. Passive Photon Remote Sensing
- 8.7.1. Introduction and Objectives
- 8.7.2. Light
- 8.7.3. Interaction of Light with Matter
- 8.7.4. Black Bodies
- 8.7.5. Other Effects
- 8.7.6. Point Cloud Diagram

8.8. Passive Remote Sensing in Ultraviolet, Visible, Infrared, Infrared, Microwave and Radio
- 8.8.1. Introduction and Objectives
- 8.8.2. Passive Remote Sensing: Photon Detectors
- 8.8.3. Visible Observation with Telescopes
- 8.8.4. Types of Telescopes
- 8.8.5. Mounts
- 8.8.6. Optics
- 8.8.7. Ultraviolet
- 8.8.8. Infrared
- 8.8.9. Microwaves and Radio Waves
- 8.8.10. netCDF4 Files

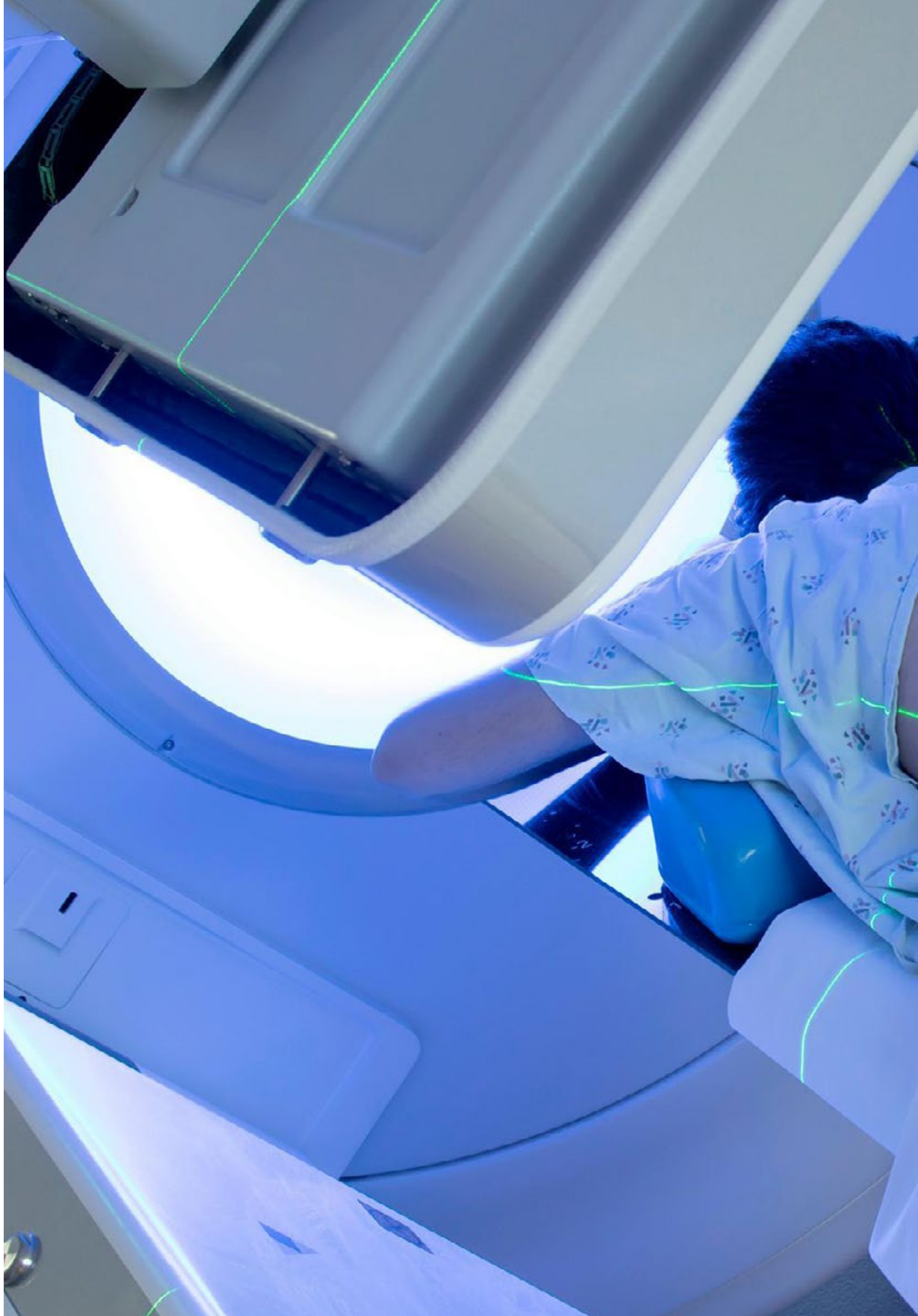
8.9. Active Remote Sensing with Lidar and Radar
- 8.9.1. Introduction and Objectives
- 8.9.2. Active Remote Sensing
- 8.9.3. Atmospheric Radar
- 8.9.4. Weather Radar
- 8.9.5. Comparison of Lidar with Radar
- 8.9.6. HDF4 Files

8.10. Passive Remote Sensing of Gamma and X-Rays
- 8.10.1. Introduction and Objectives
- 8.10.2. Introduction to X-ray Observation
- 8.10.3. Gamma Ray Observation
- 8.10.4. Remote Sensing Software

Module 9. Biophysics

9.1. Introduction to Biophysics
- 9.1.1. Introduction to Biophysics
- 9.1.2. Characteristics of Biological Systems
- 9.1.3. Molecular Biophysics
- 9.1.4. Cell Biophysics
- 9.1.5. Biophysics of Complex Systems

9.2. Introduction to the Thermodynamics of Irreversible Processes
- 9.2.1. Generalization of the Second Principle of Thermodynamics for Open Systems
- 9.2.2. Dissipation Function
- 9.2.3. Linear Relationships between Conjugate Thermodynamic Fluxes and Forces
- 9.2.4. Validity Interval of the Linear Thermodynamics
- 9.2.5. Properties of Phenomenological Coefficients
- 9.2.6. Onsager's Relations
- 9.2.7. Theorem of Minimum Entropy Production
- 9.2.8. Stability of Steady States in the Vicinity of Equilibrium. Stability Criteria
- 9.2.9. Processes Far from Equilibrium
- 9.2.10. Evolution Criteria



9.3. Arrangement in Time: Irreversible Processes away from Equilibrium
- 9.3.1. Kinetic Processes Considered as Differential Equations
- 9.3.2. Stationary Solutions
- 9.3.3. Lotka-Volterra Model
- 9.3.4. Stability of Stationary Solutions: perturbation method
- 9.3.5. Trajectories: Solutions of the Systems of Differential Equations
- 9.3.6. Types of Stability
- 9.3.7. Analysis of the Stability in the Lotka-Volterra Model
- 9.3.8. Timing: Biological Clocks
- 9.3.9. Structural Stability and Bifurcations. Brusselator's Model
- 9.3.10. Classification of the Different Types of Dynamic Behavior

9.4. Spatial Arrangement: Systems with Diffusion
- 9.4.1. Spatial-Temporal Self-Organization
- 9.4.2. Reaction-Diffusion Equations
- 9.4.3. Solutions of These Equations
- 9.4.4. Examples

9.5. Chaos in Biological Systems
- 9.5.1. Introduction
- 9.5.2. Attractors. Strange or Chaotic Attractors
- 9.5.3. Definition and Properties of Chaos
- 9.5.4. Ubiquity: Chaos in Biological Systems
- 9.5.5. Universality: Routes to Chaos
- 9.5.6. Fractal Structure Fractals
- 9.5.7. Fractal Properties
- 9.5.8. Reflections on Chaos in Biological Systems

9.6. Membrane Potential Biophysics
- 9.6.1. Introduction
- 9.6.2. First Approach to the Membrane Potential: Nernst Potential
- 9.6.3. Gibbs-Donnan Potentials
- 9.6.4. Surface Potentials

9.7. Transport across Membranes: Passive Transport
- 9.7.1. Nernst-Planck Equation
- 9.7.2. Constant Field Theory
- 9.7.3. GHK Equation in Complex Systems
- 9.7.4. Fixed Charge Theory
- 9.7.5. Action Potential Transmission
- 9.7.6. TPI Transport Analysis
- 9.7.7. Electrokinetic Phenomena

9.8. Facilitated Transport. Ion Channels Transporters
- 9.8.1. Introduction
- 9.8.2. Characteristics of Transport Facilitated by Transporters and Ion Channels
- 9.8.3. Model of Oxygen Transport with Hemoglobin Thermodynamics of Irreversible Processes
- 9.8.4. Examples

9.9. Active Transport: Effect of Chemical Reactions on Transport Processes
- 9.9.1. Chemical Reactions and Steady State Concentration Gradients
- 9.9.2. Phenomenological Description of Active Transport
- 9.9.3. The Sodium-Potassium Pump
- 9.9.4. Oxidative Phosphorylation

9.10. Nervous Impulses
- 9.10.1. Phenomenology of the Action Potential
- 9.10.2. Mechanism of the Action Potential
- 9.10.3. Hodgkin-Huxley Mechanism
- 9.10.4. Nerves, Muscles and Synapses

Module 10. Medical Physics

10.1. Natural and Artificial Radiation Sources
- 10.1.1. Alpha, Beta and Gamma Emitting Nuclei
- 10.1.2. Nuclear Reactions
- 10.1.3. Neutron Sources
- 10.1.4. Charged Particle Accelerators
- 10.1.5. X-Ray Generators

10.2. Radiation-Matter Interaction
- 10.2.1. Photon Interactions (Rayleigh and Compton Scattering, Photoelectric Effect and Electron-Positron Pair Creation)
- 10.2.2. Electron-Positron Interactions (Elastic and Inelastic Collisions, Emission of Braking Radiation or Bremsstrahlung and Positron Annihilation)
- 10.2.3. Ion Interactions
- 10.2.4. Neutron Interactions

10.3. Monte Carlo Simulation of Radiation Transport
- 10.3.1. Pseudorandom Number Generation
- 10.3.2. Random Number Drawing Techniques
- 10.3.3. Radiation Transport Simulation
- 10.3.4. Practical Examples

10.4. Dosimetry
- 10.4.1. Dosimetric Quantities and Units (ICRU)
- 10.4.2. External Exposure
- 10.4.3. Radionuclides Incorporated in the Organism
- 10.4.4. Radiation-Matter Interaction
- 10.4.5. Radiological Protection
- 10.4.6. Permitted Limits for the Public and Professionals

10.5. Radiobiology and Radiotherapy
 10.5.1. Radiobiology
 10.5.2. External Radiation Therapy with Photons and Electrons
 10.5.3. Brachytherapy
 10.5.4. Advanced Processing Methods (Ions and Neutrons)
 10.5.5. Planning
10.6. Biomedical Images
 10.6.1. Biomedical Imaging Techniques
 10.6.2. Image Enhancement using Histogram Modification
 10.6.3. Fourier Transform
 10.6.4. Filtering
 10.6.5. Restoration
10.7. Nuclear Medicine
 10.7.1. Tracers
 10.7.2. Detector Equipment
 10.7.3. Gamma Camera
 10.7.4. Planar Scintigraphy
 10.7.5. SPECT
 10.7.6. PET
 10.7.7. Small Animal Equipment
10.8. Reconstruction Algorithms
 10.8.1. Radon Transform
 10.8.2. Central Section Theorem
 10.8.3. Filtering Back Projection Algorithm
 10.8.4. Noise Filtering
 10.8.5. Iterative Reconstruction Algorithms
 10.8.6. Algebraic Algorithm (ART)
 10.8.7. Maximum Likelihood Algorithm (MLE)
 10.8.8. Ordered Subsites (OSEM)
10.9. Biomedical Image Reconstruction
 10.9.1. SPECT Reconstruction
 10.9.2. Degrading Effects Associated with Photon Attenuation, Scattering, System Response, and Noise
 10.9.3. Compensation in the Filtered Back Projection Algorithm
 10.9.4. Compensation in Iterative Methods
10.10. Radiology and Magnetic Resonance Imaging (MRI)
 10.10.1. Imaging Techniques in Radiology: Radiography and CT
 10.10.2. Introduction to MRI
 10.10.3. MRI Imaging
 10.10.4. MRI Spectroscopy
 10.10.5. Quality Control

Thanks to this Professional Master's Degree, you will be able to contribute with your technical and scientific knowledge about physics, in the creation of devices that contribute to medicine"

05
Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**
This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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

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

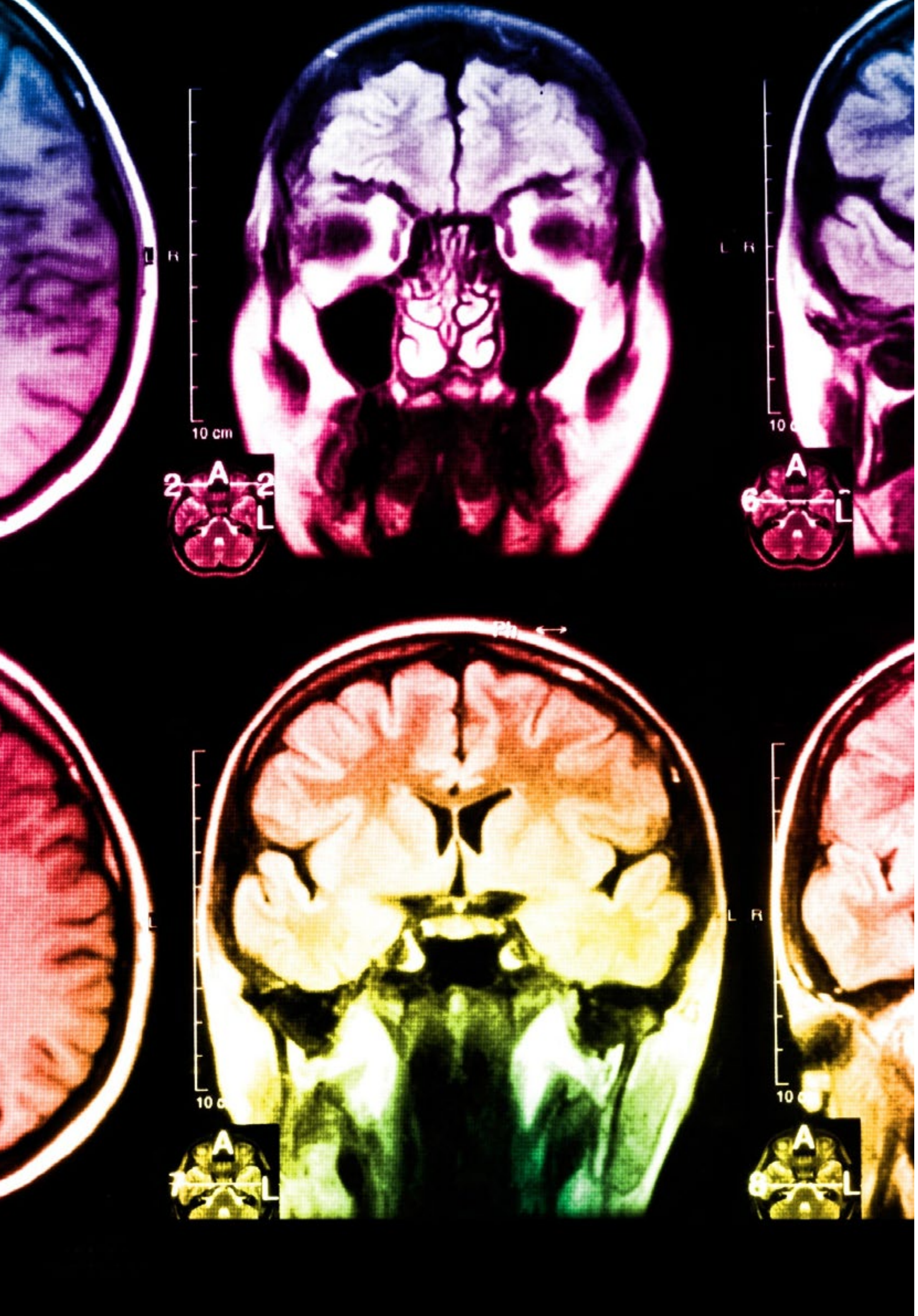
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

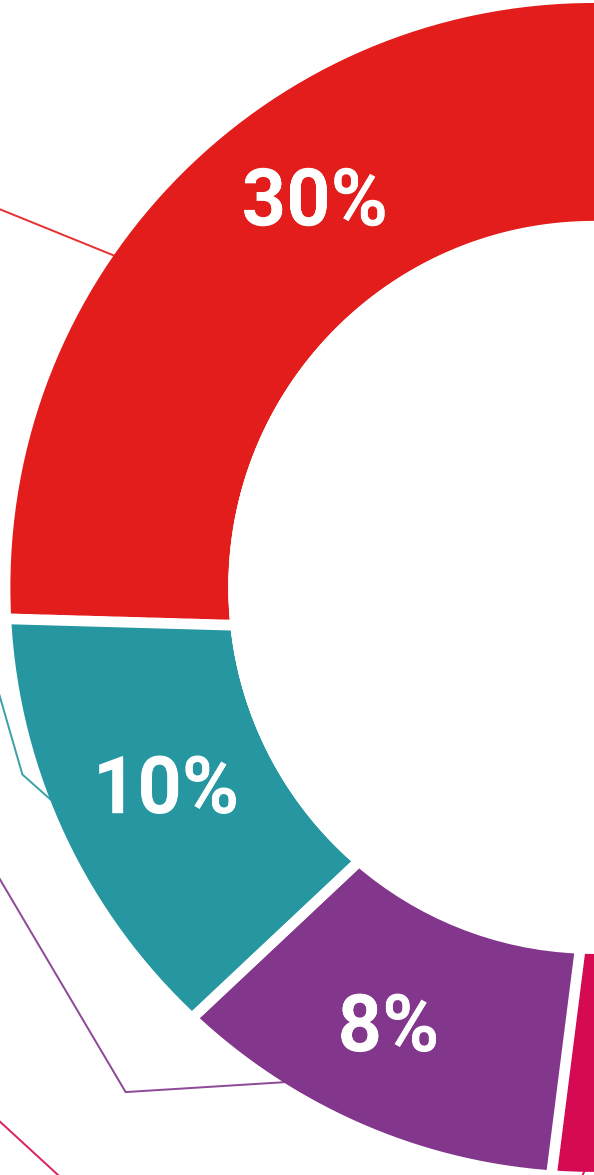
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

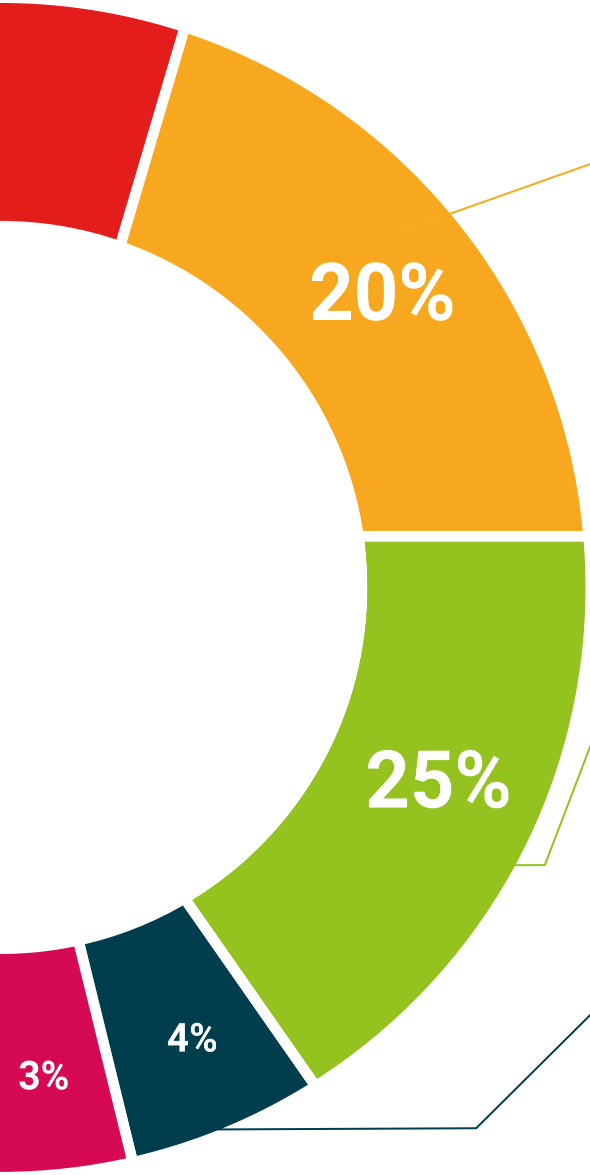
Practising Skills and Abilities

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.

06
Certificate

The Professional Master's Degree in Medical Physics guarantees you, in addition to the most rigorous and up-to-date training, access to a Professional Master's Degree issued by TECH Technological University.

Successfully complete this program and receive your university degree without travel or laborious paperwork"

This **Professional Master's Degree 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 **Professional Master's Degree** issued by **TECH Technological University** via tracked delivery*.

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

Title: **Professional Master's Degree in Medical Physics**

Official Nº of hours: **1,500 h.**

tech technological university

Awards the following

CERTIFICATE

to

Mr./Ms. _______________, with identification number ___________.
For having successfully passed and accredited the following program

PROFESSIONAL MASTER'S DEGREE

in

Medical Physics

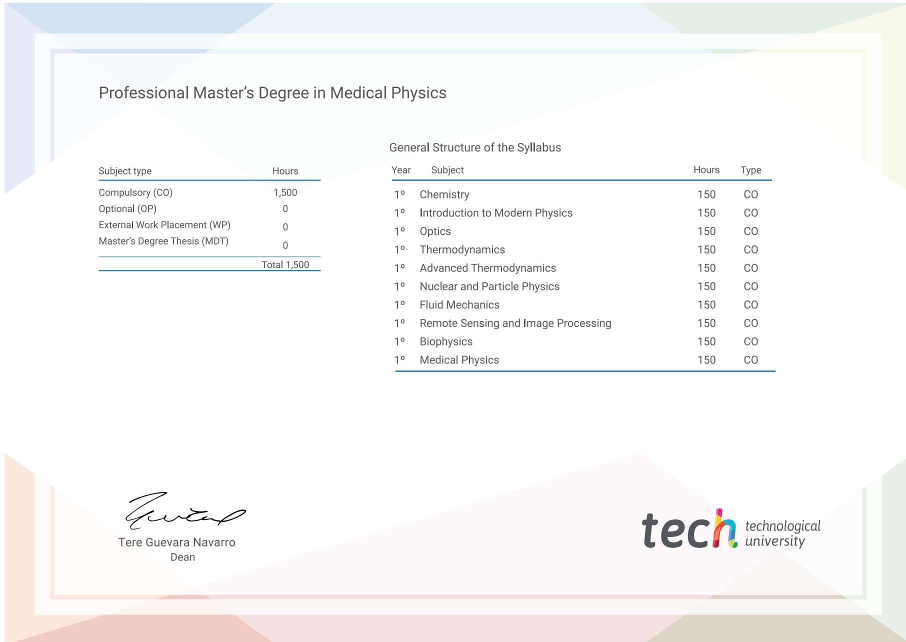
This is a qualification awarded by this University, equivalent to 1,500 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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



Professional Master's Degree in Medical Physics

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	Chemistry	150	CO
1º	Introduction to Modern Physics	150	CO
1º	Optics	150	CO
1º	Thermodynamics	150	CO
1º	Advanced Thermodynamics	150	CO
1º	Nuclear and Particle Physics	150	CO
1º	Fluid Mechanics	150	CO
1º	Remote Sensing and Image Processing	150	CO
1º	Biophysics	150	CO
1º	Medical Physics	150	CO

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Dean

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*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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Professional Master's Degree

Medical Physics

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Technological University**
- Dedication: **8h/week**
- Schedule: **at your own pace**
- Exams: **online**

Professional Master's Degree
Medical Physics

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