Postgraduate Diploma
Biomedical Electronics

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Postgraduate Diploma

Biomedical Electronics

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Global University**
- Credits: **18 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/information-technology/postgraduate-diploma/postgraduate-diploma-biomedical-electronics**

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01

Introduction

Electronics is an essential part of people's daily lives, but it has also acquired great importance in the biomedical field, since many of the most advanced tools in this sector depend on electronics to be more efficient. This is why IT professionals are increasingly seeking to specialize in this field in order to contribute, with their work and knowledge, to the advanced development of this type of devices. In this sense, this TECH program aims to offer students the best training in the market so that they can become qualified in a highly demanded field.

The specialization in Biomedical Electronics will allow you to work to improve devices that improve the quality of life and life expectancy of patients"

Applying the knowledge of electronics to develop state-of-the-art medical devices is one of the main applications of Biomedical Electronics, an area that has experienced great growth in recent years with the advances in technology. Undoubtedly, this is a fundamental sector in today's society, due to the great benefits it brings to people's health. As a result, more and more computer scientists want to specialize in this field and are looking for high-quality programs to improve their qualifications. This Postgraduate Diploma at TECH addresses these academic needs of computer scientists, with a first class program in today's academic field.

Specifically, the program includes fundamental aspects of microelectronics, analyzing the physical principles that govern the behavior of the fundamental elements of electronics; and delves into the most relevant characteristics and applications of transistors, diodes and amplifiers, among other issues. Likewise, it covers digital processing, which has experienced dramatic development in recent decades with the increasing implementation of devices based on digital electronics.

Meanwhile, the main focus of this program is on Biomedical Electronics, addressing electrophysiology, origin, conduction and acquisition of bioelectrical signals, as well as their filtering and amplification. In addition, special emphasis is placed on the importance of electrical safety of biomedical instrumentation.

In short, this is a 100% online Postgraduate Diploma that will allow students to distribute their study time, not being conditioned by fixed schedules or having the need to move to another physical location, being able to access all the contents at any time of the day, balancing their work and personal life with their academic life.

This **Postgraduate Diploma in Biomedical Electronics** contains the most complete and up-to-date program on the market. Its most notable features are:

- Practical cases presented by experts in information technology
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional development
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies in Biomedical Electronics
- 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

Biomedical Electronics has advanced a lot in recent years, so the higher-level specialization of computer scientists in this field becomes highly relevant"

Complete this Postgraduate Diploma and quickly increase your job opportunities"

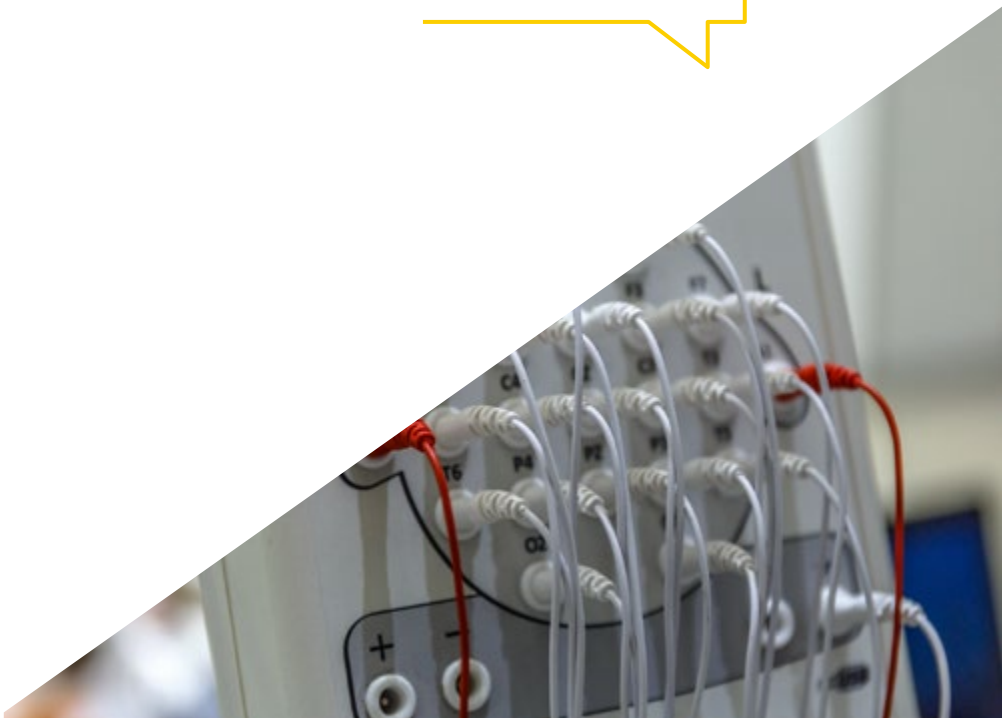
Carrying out the multiple practical cases that TECH provides you with will help you to refine your theoretical knowledge.

The online format of this Postgraduate Diploma will give you the opportunity to self-manage your study time.

The teaching staff includes professionals from the information technology sector, who bring their experience to this training 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 an immersive training experience designed to train for real-life situations.

This program is designed around Problem-Based Learning, whereby the student must try to solve the different professional practice situations that arise throughout the program. This will be done with the help of an innovative system of interactive videos made by renowned experts.



02

Objectives

The main objective of this Postgraduate Diploma in Biomedical Electronics at TECH is to offer computer scientists totally innovative and up-to-date information, which is fundamental for the development of medical equipment and, therefore, for society. A program which allows students to develop the necessary skills and competences to stand out in a currently extensively competitive sector which demands professionals with a high level of qualification and experience in electronics.

If you want to specialize in the field of Biomedical Electronics, this Postgraduate Diploma is the program for you"

General Objectives

- Gather the main materials involved in micro-electronics, their properties and applications
- Identify the functioning of the fundamental structures of microelectronic devices
- Gain in-depth knowledge of the mathematical principles governing microelectronics
- Analyze signals and modify them
- Examine the current techniques of digital processing
- Implement solutions for digital signal processing (images and audio)
- Simulate digital signals and devices capable of processing them
- Program elements for signal processing
- Design filters for digital processing
- Work with mathematical tools for digital processing
- Evaluate the different options for signal processing
- Identify and evaluate the bioelectric signals involved in a biomedical application
- Determine the design protocol of a biomedical application
- Analyze and evaluate designs of biomedical instruments
- Identify and define the interferences and noise of a biomedical application
- Evaluate and apply electrical safety regulations

Specific Objectives

Module 1. Microelectronics

- Generate specialized knowledge of microelectronics
- Examine analog and digital circuits
- Determine the fundamental characteristics and uses of diodes
- Determine the functioning of an amplifier
- Develop autonomy in the design of transistors and amplifiers according to the desired use
- Demonstrate the math behind the most common components in electronics
- Analyze signals from their frequency response
- Evaluate the stability of a control
- Identify the main lines of technology development

Module 2. Digital Processing

- Convert an analog signal into a digital one
- Differentiate between the types of digital systems and their properties
- Analyze the frequencial behavior of a digital system
- Process, encode and decode images
- Simulate digital processing for voice recognition

Module 3. Biomedical Electronics

- Analyze direct or indirect signals that can be measured with non-implantable devices
- Apply acquired knowledge on sensors and transduction in biomedical applications
- Determine the use of electrodes in bioelectric signal measurements
- Develop the use of amplification systems, separation and signal filtering
- Examine the different physiological systems of the human body and the signals for the analysis of their behavior
- Apply, in a practical way, knowledge of physiological systems in the measurement tools of the most important systems: ECG, EEG, EMG, Spirometry and Oximetry
- Establish the necessary electric safety of biomedical instruments

A unique program that will help you to learn the particularities of Biomedical Electronics”

03

Course Management

The teachers of this Postgraduate Diploma in Biomedical Electronics at TECH have extensive experience in the field of information technology and have dedicated a large part of the academis and work life to specializing in this field. For this reason, they have the necessary training to offer their students the most up-to-date information of the moment, which will allow them to take a step forward in their qualification, being able to dedicate themselves, in the future, to work with devices that can be used in the health field.

The best teaching team of the moment to help you specialize in a highly-demanded area"

Management

Ms. Casares Andrés, María Gregoria

- Associate professor at Carlos III University of Madrid
- Degree in IT from the Polytechnic University of Madrid
- Researcher at Polytechnic University of Madrid
- Researcher at Carlos III University of Madrid
- Evaluator and creator of OCW courses at Carlos III University of Madrid
- Tutor of courses at INTEF (National Agency for Educational Technology and Teacher Development)
- Support Technician at the Ministry of Education Directorate General of Bilingualism and Quality of Education of the Community of Madrid
- Middle and high school teacher specializing in IT
- Associate professor off the Pontificia de Cimillas University
- Teaching Expert in the Community of Madrid
- Analyst / Project Manager at Banco Urquijo Computer Systems
- ERIA Computer Analyst

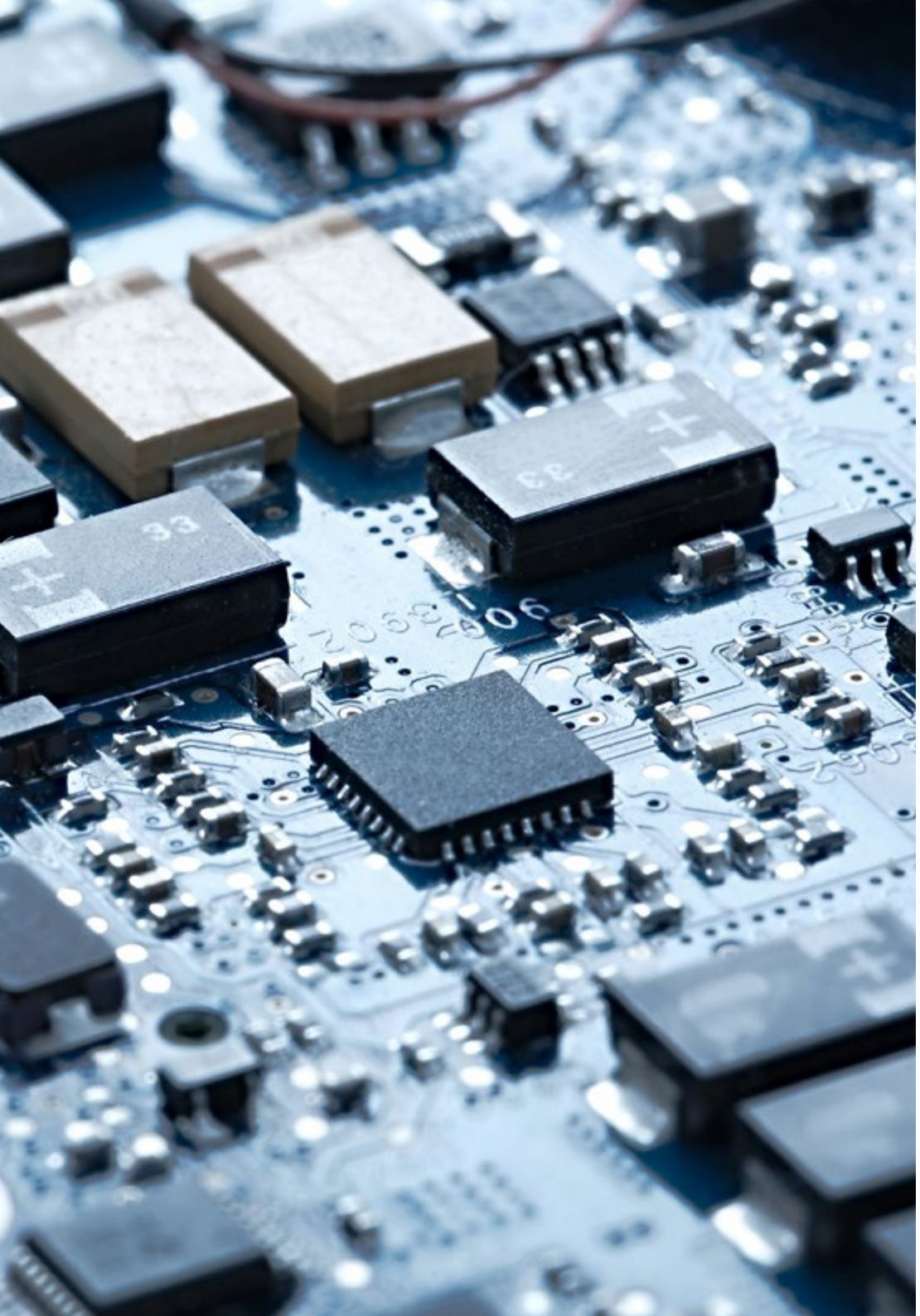
Professors

Ms. Sánchez Fernández, Elena

- Field Service Engineer at BD Medical, performing corrective tasks, installation and maintenance of microbiology equipment.
- Degree in Computer Engineering from Carlos III University de Madrid.
- Master's Degree in Electronic Systems from the Polytechnic University of Madrid.
- Intern at the Microelectronics Department of the UPM, designing and simulating temperature sensors for biomedical applications.
- Intern at the Microelectronics Department of the UC3M, designing and characterization of low voltage CMOS ASIC for medical equipment
- Intern in the movement analysis laboratory EUF-ONCE | ONCE-UAM, Madrid

Mr. Ruiz Díez, Carlos

- Researcher at the National Microelectronics Center of the CSIC.
- Director of Competitive Engineering Training at ISC
- Voluntary trainer in the Caritas Employment Workshops



- Researcher in practices in the Composting Research Group of the Department of Chemical, Biological and Environmental Engineering of the UAB.
- Founder and product development at NoTime Ecobrand, a fashion and recycling brand.
- Development cooperation project manager for the NGO Future Child Africa in Zimbabwe.
- ICAI Speed Club: motorcycle racing team
- Graduate in Industrial Technologies Engineering from Pontificia de Comillas University ICAI.
- Master's Degree in Biological and Environmental Engineering from the Autonomous University of Barcelona.
- Master's Degree in Environmental Management from the Universidad Española a Distancia (Spanish Open University)

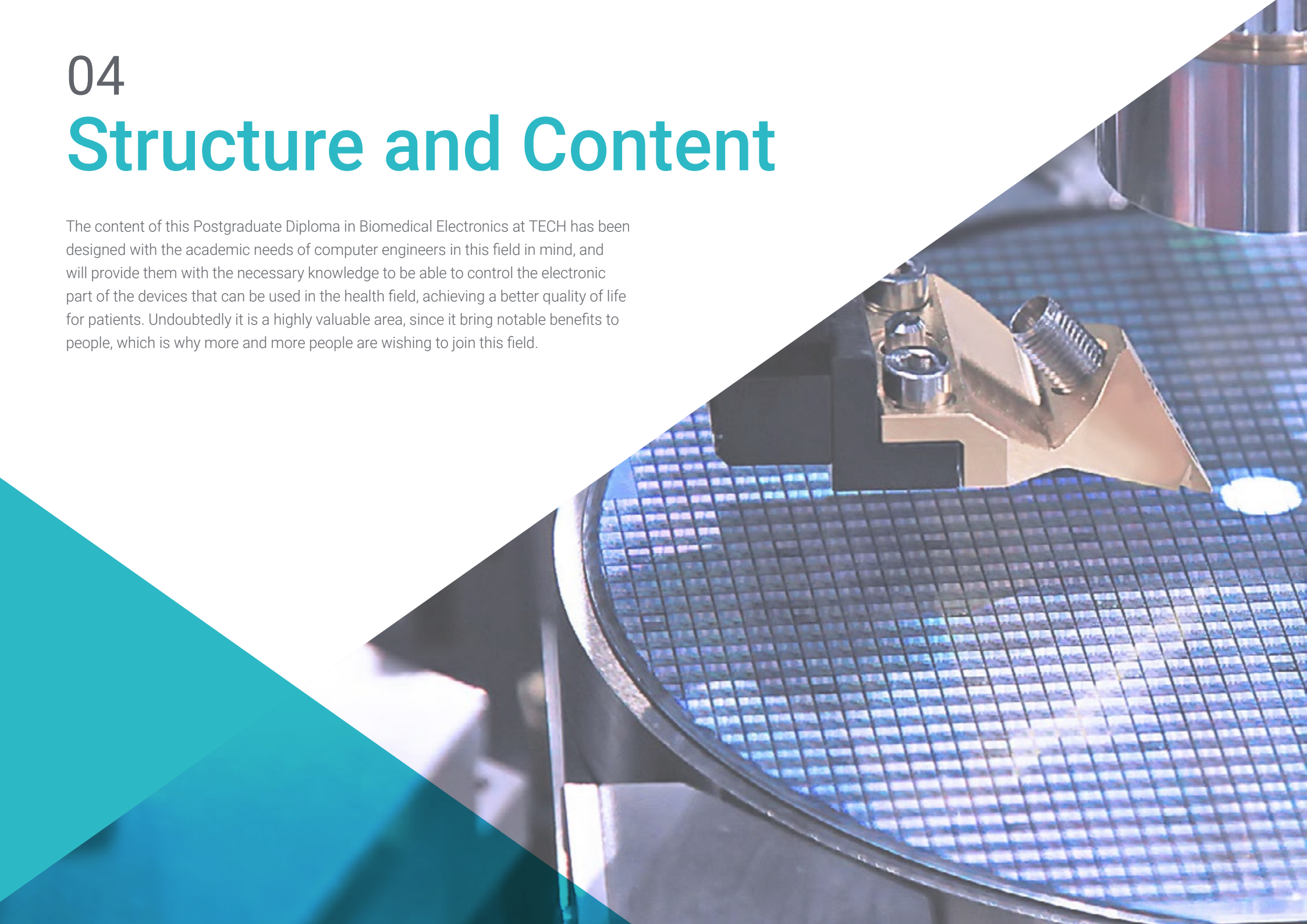
Mr. Torralbo Vecino, Manuel

- Electronic engineer in UCAnFly Project
- Electronic engineer in Airbus D&S
- Degree in Industrial Electronics and Automation Engineering at University of Cadiz
- IPMA Level D certification as Project Manager

04

Structure and Content

The content of this Postgraduate Diploma in Biomedical Electronics at TECH has been designed with the academic needs of computer engineers in this field in mind, and will provide them with the necessary knowledge to be able to control the electronic part of the devices that can be used in the health field, achieving a better quality of life for patients. Undoubtedly it is a highly valuable area, since it bring notable benefits to people, which is why more and more people are wishing to join this field.



The most complete syllabus on Biomedical Electronics on the market"

Module 1. Microelectronics

1.1. Microelectronics vs. Electronics
- 1.1.1. Analog Circuits
- 1.1.2. Digital Circuits
- 1.1.3. Signals and Waves
- 1.1.4. Semi-Conductor Materials

1.2. Semi-Conductor Properties
- 1.2.1. Structure of the PN Junction
- 1.2.2. Reverse Breakdown
  - 1.2.2.1. Zener Breakdown
  - 1.2.2.2. Avalanche Breakdown

1.3. Diodes
- 1.3.1. Ideal Diode
- 1.3.2. Rectifier
- 1.3.3. Characteristics of the Diode Junction
  - 1.3.3.1. Direct Polarization Current
  - 1.3.3.2. Inverse Polarization Current
- 1.3.4. Applications

1.4. Transistors
- 1.4.1. Structure and Physics of a Bipolar Transistor
- 1.4.2. Operation of a Transistor
  - 1.4.2.1. Active Mode
  - 1.4.2.2. Saturation Mode

1.5. MOS Field-Effect Transistors (MOSFETs)
- 1.5.1. Structure
- 1.5.2. The I-V Features
- 1.5.3. MOSFET Circuits in Continuous Current
- 1.5.4. The Body Effect

1.6. Operational Amplifiers
- 1.6.1. Ideal Amplifiers
- 1.6.2. Settings
- 1.6.3. Differential Amplifiers
- 1.6.4. Integrators and Differentiators

1.7. Operational Amplifiers. Uses
- 1.7.1. Bipolar Amplifiers
- 1.7.2. CMOS
- 1.7.3. Amplifiers as Black Boxes

1.8. Frequency Response
- 1.8.1. Analysis of the Frequency Response
- 1.8.2. High Frequency Response
- 1.8.3. Low Frequency Repsonse
- 1.8.4. Examples:

1.9. *Feedback*
- 1.9.1. General Structure of *Feedback*
- 1.9.2. Properties and Methodology for the Analysis of *Feedback*
- 1.9.3. Stability: Bode Method
- 1.9.4. Compensation in Frequency

1.10. Sustainable Microelectronics and Future Trends
- 1.10.1. Sustainable Energy Sources
- 1.10.2. Bio-Compatible Sensors
- 1.10.3. Future Trends in Microelectronics

Module 2. Digital Processing

2.1. Discrete Systems
- 2.1.1. Discrete Signals
- 2.1.2. Stability of Discrete Systems
- 2.1.3. Frequency Response
- 2.1.4. Fourier Transform
- 2.1.5. Z Transform
- 2.1.6. Signal Sample

2.2. Convolution and Correlation
- 2.2.1. Signal Correlation
- 2.2.2. Signal Convolution
- 2.2.3. Examples of Application

2.3. Digital Filters
- 2.3.1. Classes of Digital Filters
- 2.3.2. Hardware Used for Digital Filters
- 2.3.3. Frequential Analysis
- 2.3.4. Effects of the Filtering on the Signals

2.4. Finite Impulse Response (FIR) Filters
- 2.4.1. Non-Infinite Impulse Response
- 2.4.2. Linearity
- 2.4.3. Determination of Poles and Zeros
- 2.4.4. Design of FIR Filters

2.5. Infinite Impulse Response (IIR) Filters
- 2.5.1. Recursive Filters
- 2.5.2. Infinite Impulse Response
- 2.5.3. Determination of Poles and Zeros
- 2.5.4. Design of IIR Filters

2.6. Signal Modulation
- 2.6.1. Amplitude Modulation
- 2.6.2. Frequency Modulation
- 2.6.3. Phase Modulation
- 2.6.4. Demodulators
- 2.6.5. Simulators

2.7. Digital Processing of Images
- 2.7.1. Color Theory
- 2.7.2. Sampling and Quantification
- 2.7.3. Digital Processing with OpenCV

2.8. Advanced Techniques in Digital Processing of Images
- 2.8.1. Image Recognition
- 2.8.2. Evolutionary Algorithms for Images
- 2.8.3. Image Databases
- 2.8.4. *Machine Learning* Applied to Writing

2.9. Digital Processing of Voice
- 2.9.1. Digital Model of the Voice
- 2.9.2. Representation of the Voice Signal
- 2.9.3. Voice Codification

2.10. Advanced Processing of Voice
- 2.10.1. Voice Recognition
- 2.10.2. Voice Signal Processing for Diction
- 2.10.3. Digital Speech Therapy Diagnosis

Module 3. Biomedical Electronics

3.1. Biomedical Electronics
- 3.1.1. Biomedical Electronics
- 3.1.2. Characteristics of Biomedical Electronics
- 3.1.3. Biomedical Instruments Systems
- 3.1.4. Structure of a Biomedical Instrument System

3.2. Bioelectrical Signals
- 3.2.1. Origin of Biomedical Signals
- 3.2.2. Conduction
- 3.2.3. Potentials
- 3.2.4. Propagation of Potentials

3.3. Treatment of Bioelectrical Signals
- 3.3.1. Collecting Bioelectrical Signals
- 3.3.2. Amplification Techniques
- 3.3.3. Security and Isolating

3.4. Filtering Bioelectrical Signals
- 3.4.1. Noise
- 3.4.2. Noise Detection
- 3.4.3. Noise Filtering

3.5. Electrocardiogram
- 3.5.1. The Cardiovascular System
  - 3.5.1.1. Action Potentials
- 3.5.2. ECG Waveform Nomenclature
- 3.5.3. Cardiac Electrical Activity
- 3.5.4. Electrocardiography Module Instrumentation

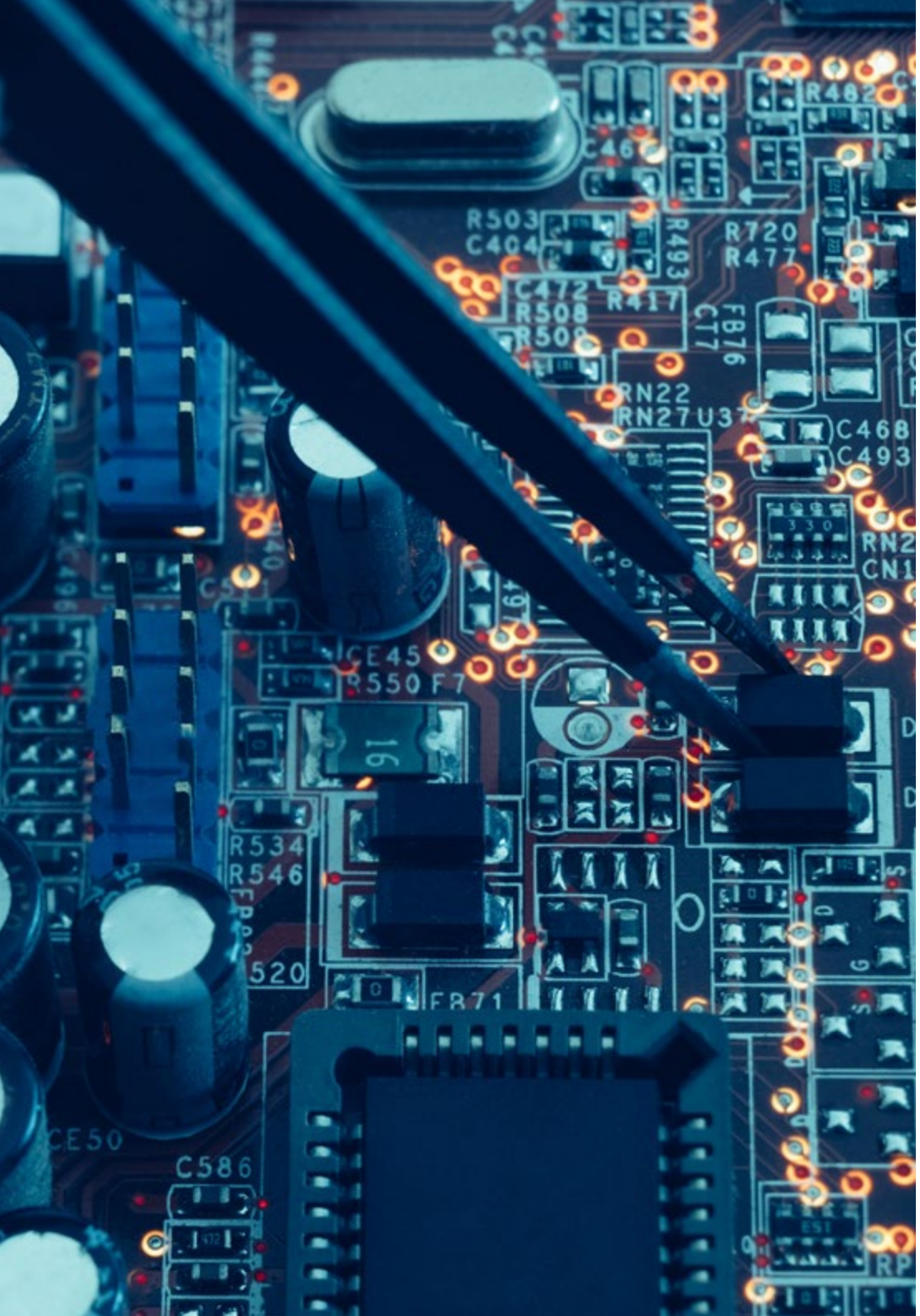
3.6. Electroencephalogram
- 3.6.1. Neurological System
- 3.6.2. Brain Electrical Activity
  - 3.6.2.1. Cerebal Waves
- 3.6.3. Electroencephalography Module Instruments

3.7. Electromyogram
- 3.7.1. The Muscular System
- 3.7.2. Muscular Electrical Activity
- 3.7.3. Electromyography Module Instrumentation

3.8. Spirometry
- 3.8.1. Respiratory System
- 3.8.2. Spirometric Parameters
  - 3.8.2.1. Interpretation of the Spirometric Test
- 3.8.3. Spirometry Module Instrumentation

3.9. Oximetry
- 3.9.1. Circulatory System
- 3.9.2. Operation Principle
- 3.9.3. Accuracy of Measurements
- 3.9.4. Oximetry Module Instrumentation

3.10. Safety and Electric Regulations
- 3.10.1. Effects of Electrical Currents in Living Beings
- 3.10.2. Electrical Accidents
- 3.10.3. Electromedical Equipment Electrical Safety
- 3.10.4. Classification of the Electromedical Equipment



A first class program with which to expand your knowledge and training in Biomedical Electronics"

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 has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. 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 course, students 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

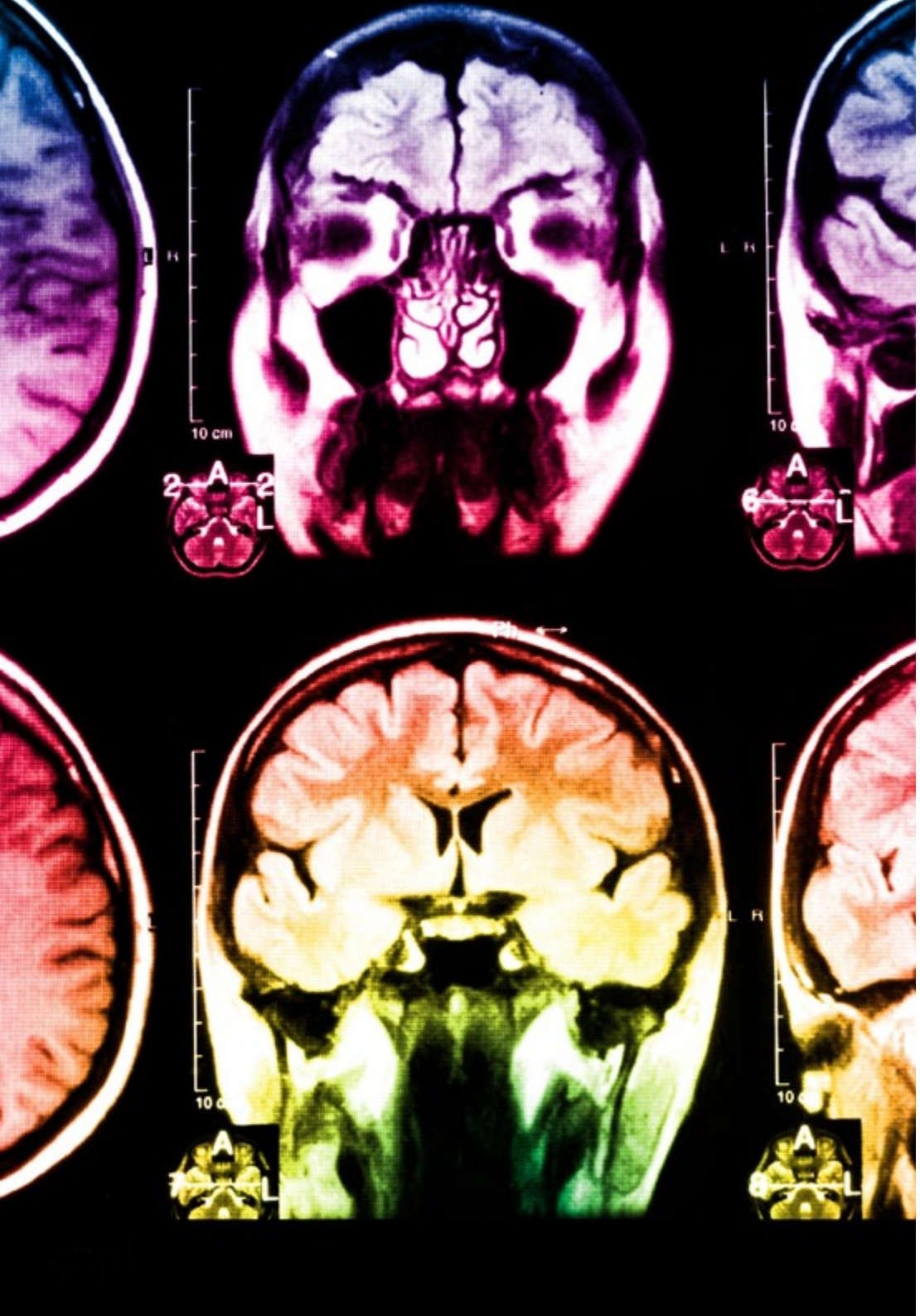
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

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.

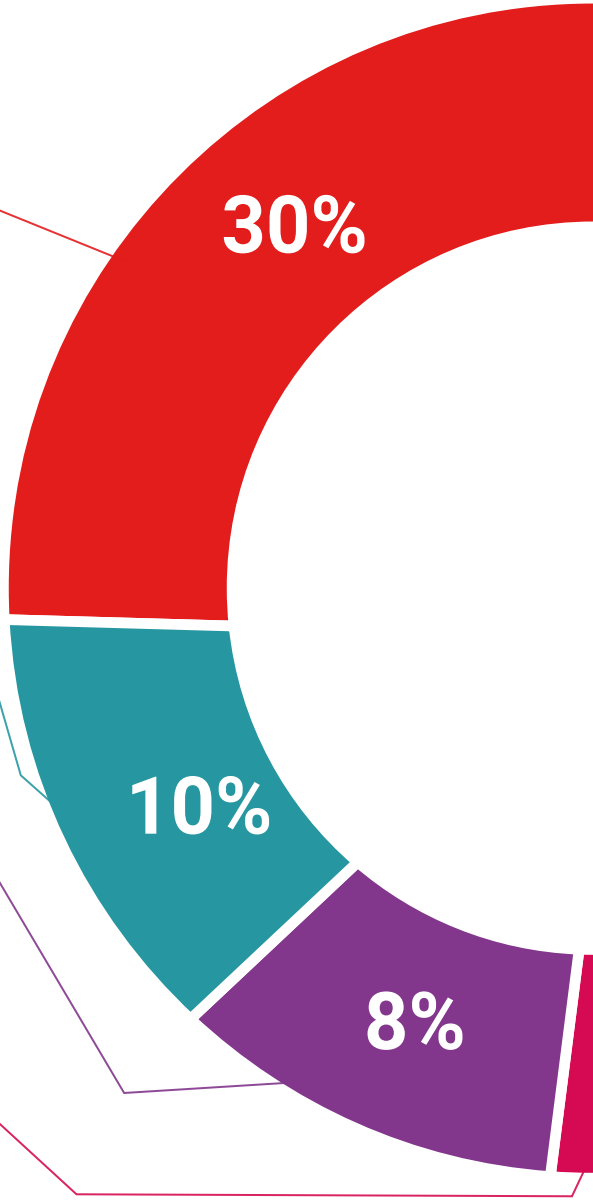
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

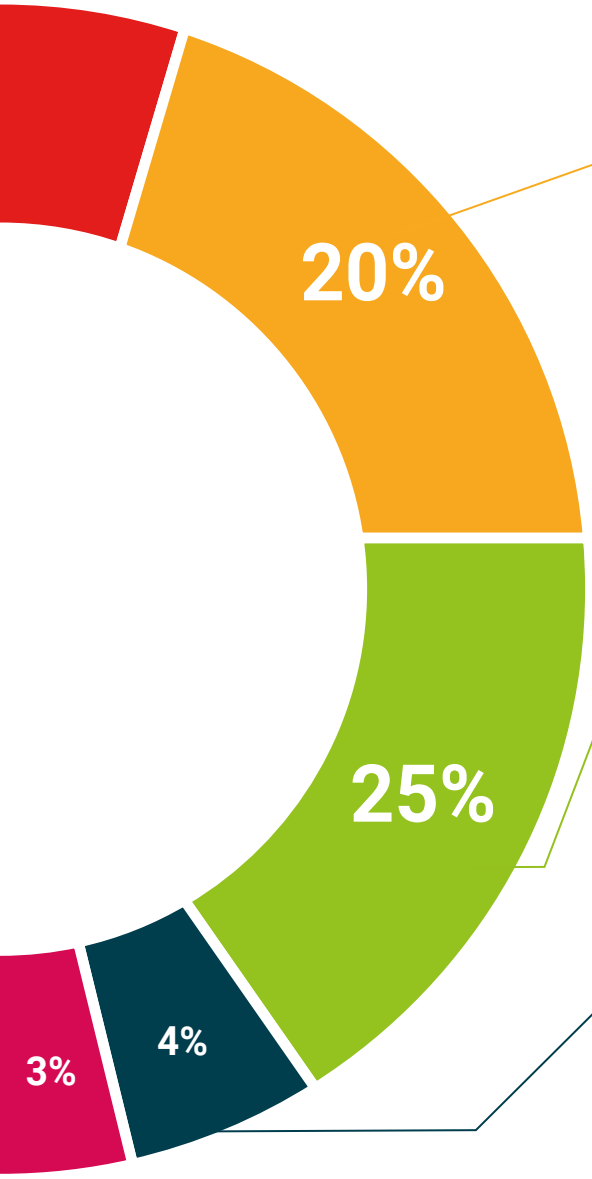
Practising Skills and Abilities

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 Postgraduate Diploma in Biomedical Electronics guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Global University.

By successfully completing this program, you will receive your TECH qualification without the need for complicated paperwork"

This program will allow you to obtain your **Postgraduate Diploma in Biomedical Electronics** endorsed by **TECH Global University**, the world's largest online university.

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

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

Title: **Postgraduate Diploma in Biomedical Electronics**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**

tech global university

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

Postgraduate Diploma in Biomedical Electronics

This is a program of 450 hours of duration equivalent to 18 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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

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

Dr. Pedro Navarro Illana
Chancellor

Unique TECH Code: AFWORD23S techtitute.com/certificates

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

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