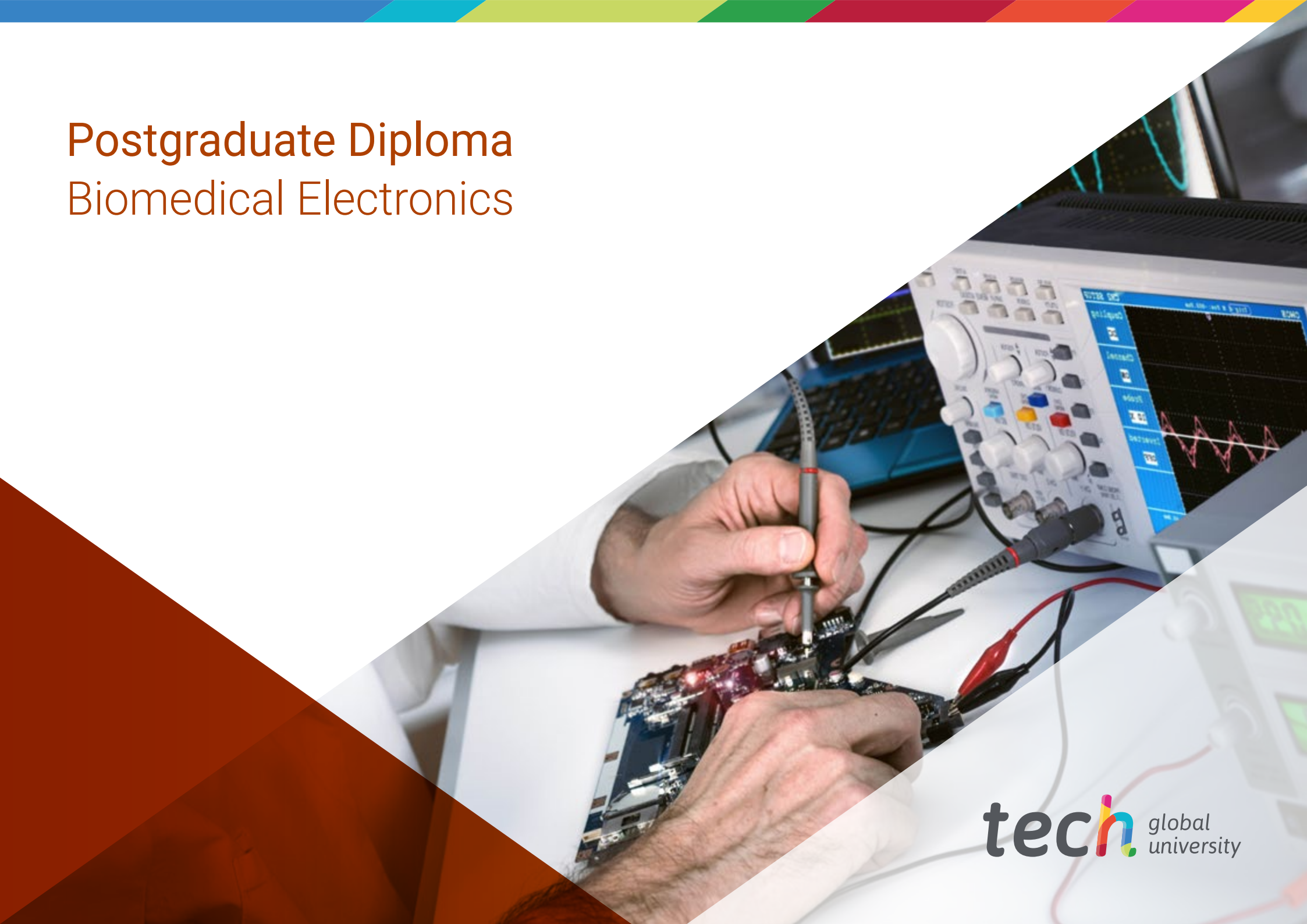
Postgraduate Diploma
Biomedical Electronics



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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/engineering/postgraduate-diploma/postgraduate-diploma-biomedical-electronics**

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01

Introduction

The application of knowledge of electronics to develop the latest generation of 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. There is no doubt that 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 engineers want to specialize in this field and are looking for high-quality programs to improve their qualifications. In order to achieve this goal, TECH has developed this academic program, which features the most revolutionary advances of the last few years in the sector.

Become a specialist in Biomedical Electronics and work to create the most revolutionary devices that can be used in the healthcare field with guaranteed success"

Electronics is present in nearly all areas of daily life, but if there is one where its presence is completely innovative, it is in the healthcare sector. The emergence of new and increasingly effective mechanisms has made it possible to diagnose diseases in time or to apply the latest treatments, thus improving the health of patients and increasing life expectancy. Meanwhile, investment in biomedical research and engineering is increasing, as large institutions and private companies have become aware of the importance of their development for the future of healthcare. For this reason, many engineers decide to diversify their field of action, directing their studies towards Biomedical Electronics and, for this reason, TECH has designed this program, which will enable professionals in the sector to broaden their knowledge in this field.

For this purpose, a very complete program has been structured, which 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. Furthermore, digital processing is studied, which has experienced a vertiginous development in the last decades with the increasing implementation of devices based on digital electronics. Yet, naturally, focusing on Biomedical Electronics, addressing electrophysiology, the origin, conduction and acquisition of bioelectrical signals, as well as their filtering and amplification.

In short, a 100% online Postgraduate Diploma that will allow students to manage their own study time, meaning they are not hindered by fixed schedules or the need to commute to another physical location. They can access all the contents at any time of the day, allowing them to balance their professional 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. The most important features include:

- Case studies presented by engineering experts
- 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 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

Biomedicine requires professionals like you, capable of creating those electronic instruments that will change healthcare"

Open the doors to a new path full of job opportunities in the Biomedical Electronics sector"

TECH offers you a multitude of theoretical and practical cases that will be very useful to improve your knowledge in this field.

Upon successful completion of this program, you will have acquired the necessary qualifications to enter a highly competitive industry.

Its teaching staff includes professionals from the field of engineering, who contribute their work experience to this program, as well as renowned specialists from leading companies and prestigious universities.

Its multimedia content, developed with the latest educational technology, will allow professionals to learn in a contextual and situated learning environment, i.e., a simulated environment that will provide immersive specialization for real 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. For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

This program in Biomedical Electronics at TECH has been designed with the main objective of offering engineers a unique study opportunity to specialize in this field. In this way, this program will open the doors to a complex field of knowledge, allowing them to learn first-hand about the electronic devices that can be used in medical practices to diagnose and treat diseases effectively, thus improving the health of patients.

A top-level program designed to foster your professional growth in the field of Biomedical Electronics"

General Objectives

- Compile the main materials involved in microelectronics, properties and applications
- Identify the operation of the fundamental structures of microelectronic devices
- Understand the mathematical principles that govern microelectronics
- Analyze signals and modify them
- Examine the current techniques in digital processing
- Implement solutions for the processing of digital signals (images and audio)
- Simulating digital signals and devices capable of processing them
- Program elements for signal processing
- Design filters for digital processing
- Operate with mathematical tools for digital processing
- Value the different options for signal processing
- Identify and evaluate bioelectrical signals involved in a biomedical application
- Determine a design protocol of a biomedical application
- Analyze and evaluate biomedical instruments designs
- 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 on microelectronics
- Examine analog and digital circuits
- Determine the fundamental characteristics and uses of a diode
- Determine how an amplifier works
- Develop proficiency in the design of transistors and amplifiers according to the desired use
- Demonstrate the mathematics behind the most common components in electronics
- Analyze signals from their frequency response
- Evaluating 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 frequency behavior of a digital system
- Process, code and de-code images
- Simulate digital processors for voice recognition

Module 3. Biomedical Electronics

- Analyze the signals, direct or indirect, that can be measured with non-implantable devices
- Apply the acquired knowledge of sensors and transduction in biomedical applications
- Determine the use of electrodes in bioelectrical signal measurements
- Develop the use of signal amplification, separation and filtering systems
- Examine the different physiological systems of the human body and signals for behavioral analysis
- Carry out a practical application of the knowledge of physiological systems in the measurement instrumentation of the most important systems: ECG, EEG, EMG, spirometry, and oximetry
- Establish the necessary electrical safety of biomedical instruments

If you are looking for the best program in Biomedical Electronics, don't think twice, this is the program for you"

03

Course Management

TECH has selected a faculty team with extensive teaching experience in the field of Biomedical Electronics for the development and delivery of this Postgraduate Diploma. Professionals engaged with society and teaching who are devoted to teaching and are specialized in Biomedical Electronics, and who have selected the most up-to-date information on the market so that students can deepen their knowledge in a field that is becoming more and more relevant.

Our experienced teachers will help you on your way to specialization"

Management

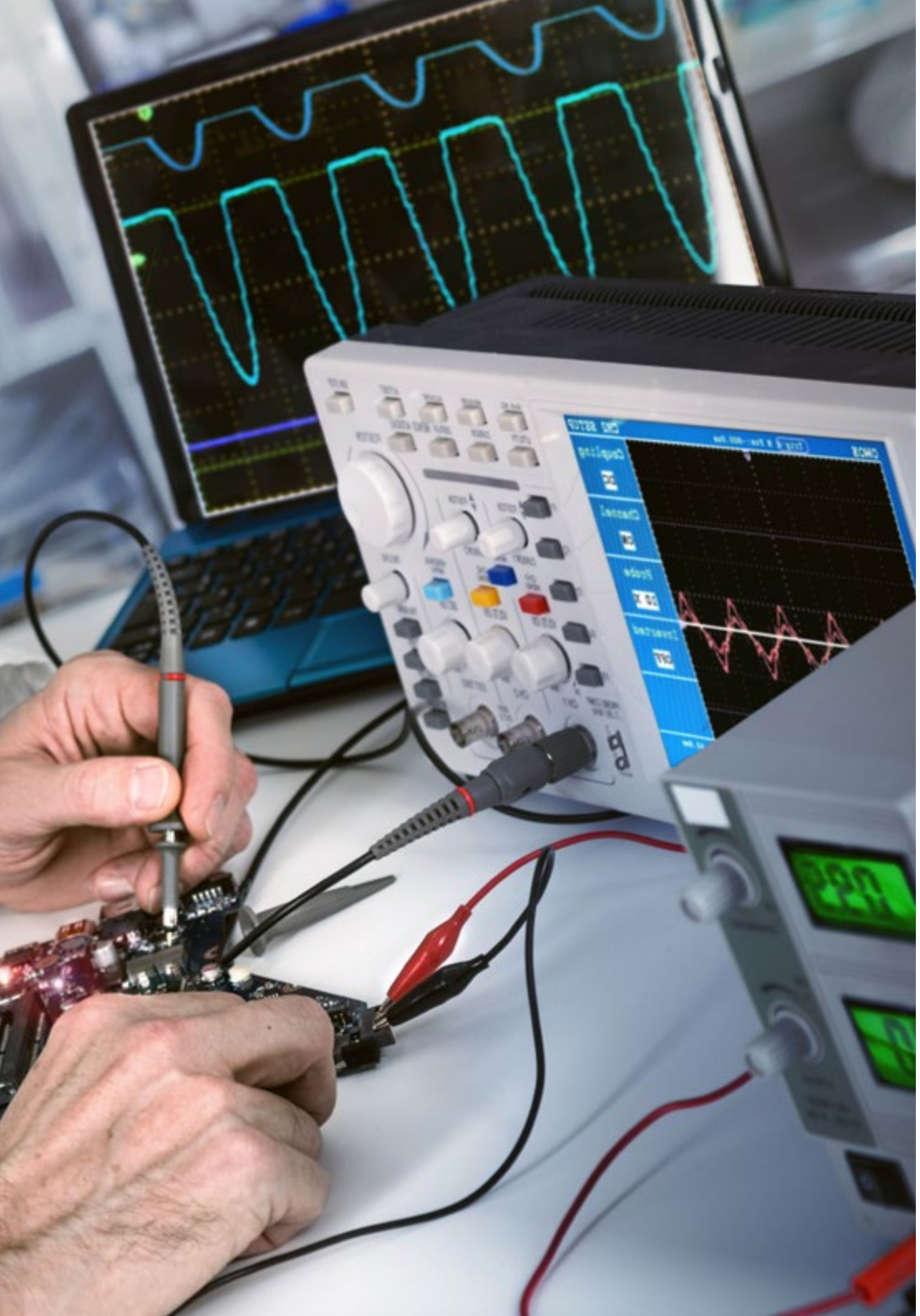
Ms. Casares Andrés, María Gregoria

- Associate Professors, Carlos III University of Madrid
- Degree in IT Polytechnic University of Madrid
- Research Sufficiency Polytechnic University of Madrid
- Research Sufficiency, Carlos III University of Madrid
- Evaluator and Creator of OCW courses at Carlos III University of Madrid
- INTEF courses tutor
- Support Technician, Ministry of Education Directorate General of Bilingualism and Quality of Education of the Community of Madrid
- Secondary Education Professor with specialty in IT
- Associate professor at the Pontificia de Comillas University
- Postgraduate Diploma in Teaching Unit, Community of Madrid
- Analyst/ IT Project manager, Banco Urquijo
- IT Analyst at ERIA

Professors

Mr. Torralbo Vecino, Manuel

- Electronic Engineer in UCAnFly Project
- Electronic Engineer in Airbus D&S
- Degree in Industrial Electronic Engineering from University of Cadiz
- IPMA Level Certification as Project Manager



Mr. Ruiz Díez, Carlos

- Researcher at the National Microelectronics Center of the CSIC
- Director of Competitive Engineering Training at ISC
- Volunteer trainer at Caritas Employment Classroom
- Research intern 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 University de Comillas ICAI
- Master's Degree in Biological and Environmental Engineering from the Autonomous University of Barcelona
- Master's Degree in Environmental Management from the Spanish Distance Learning University

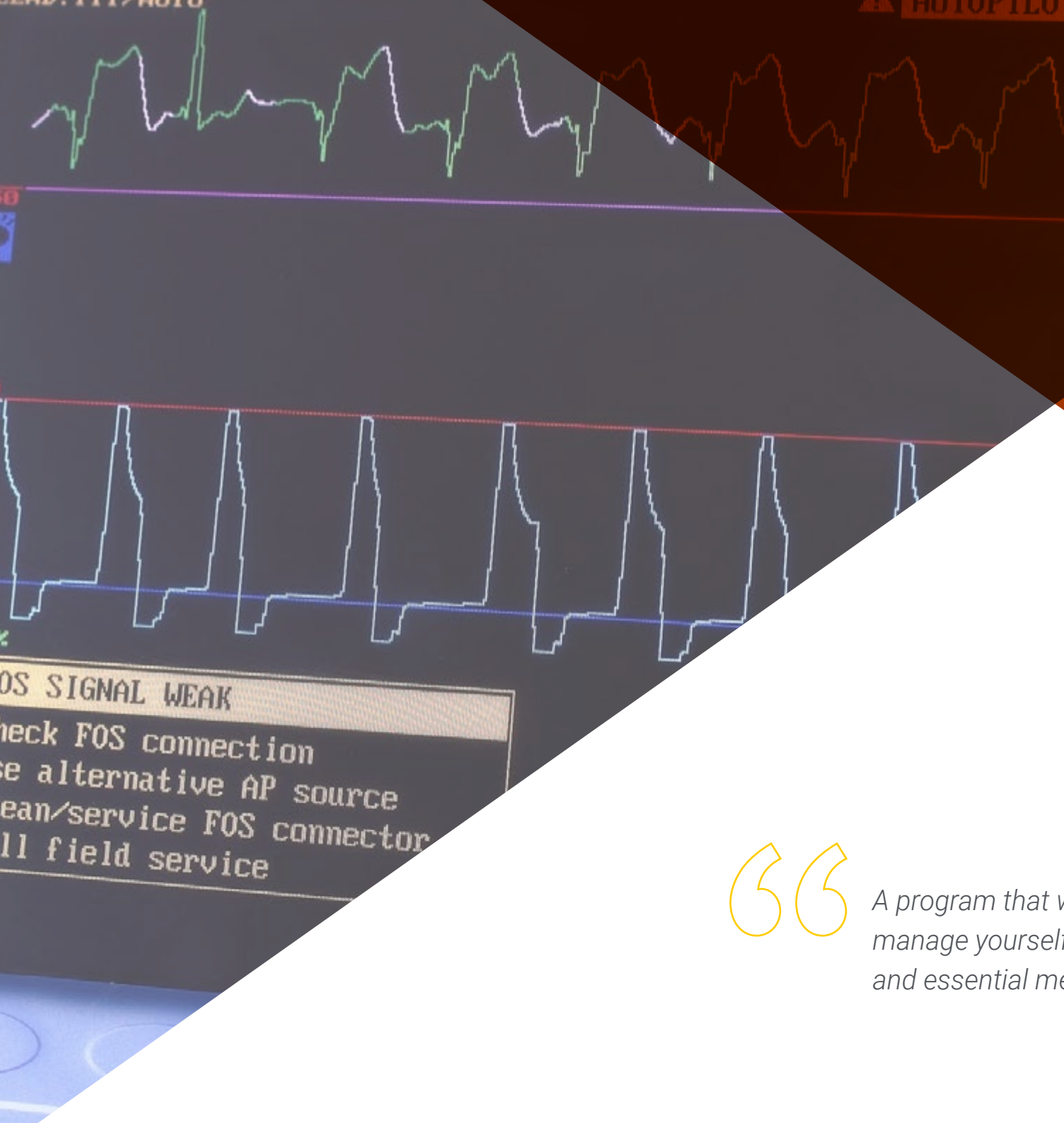
Ms. Sánchez Fernández, Elena

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

04

Structure and Content

The contents of this TECH Postgraduate Diploma cover issues such as Biomedical Electronics, microelectronics or digital processing, fundamental aspects for the engineer who wishes to develop professionally in the creation and control of electronic mechanisms that can help improve people's health. A program that is organized in a structural way so that students, little by little and in a self-directed manner, can acquire the knowledge that they can later apply to their daily practice.



A program that will help you to manage yourself in a highly specialized and essential medical environment"

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. Semiconductor Materials

1.2. Semiconductor Properties
- 1.2.1. PN Joint Structure
- 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. Diode Junction Characteristics
  - 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. DC MOSFET Circuits
- 1.5.4. The Body Effect

1.6. Operational Amplifier
- 1.6.1. Ideal Amplifier
- 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 Frequency Response
- 1.8.2. High-Frequency Response
- 1.8.3. Low-Frequency Response
- 1.8.4. Examples

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

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. The 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. Application Examples

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

2.4. Non-Recursive Filters (FIR)
- 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. Recursive Filters (IIR)
- 2.5.1. Recursion in 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. Modulation in Amplitude
- 2.6.2. Modulation in Frequency
- 2.6.3. Modulation in Phase
- 2.6.4. Demodulators
- 2.6.5. Simulators

2.7. Digital Image Processing
- 2.7.1. Color Theory
- 2.7.2. Sample and Quantification.
- 2.7.3. Digital Processing with OpenCV

2.8. Advanced Techniques in Image Digital Processing
- 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. Voice Digital Processing
- 2.9.1. Voice Digital Processing Model
- 2.9.2. Representation of the Voice Signal
- 2.9.3. Voice Codification

2.10. Advanced Voice Processing
- 2.10.1. Voice Recognition
- 2.10.2. Speech 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 Instrument Systems
- 3.1.4. Structure of a Biomedical Instrumentation System

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

3.3. Bioelectrical Signal Processing
- 3.3.1. Bioelectrical Signal Acquisition
- 3.3.2. Amplification Techniques
- 3.3.3. Safety and Insulation

3.4. Bioelectrical Signal Filter
- 3.4.1. Noise
- 3.4.2. Noise Detection
- 3.4.3. Noise Filtering

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

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

3.7. Electromyogram
- 3.7.1. The Muscular System
- 3.7.2. Electrical Muscular 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. Electrical Safety and Regulations
- 3.10.1. Effects of Electric Currents on Living Things
- 3.10.2. Electrical Accidents
- 3.10.3. Electrical Safety of Electromedical Equipment
- 3.10.4. Classification of Electromedical Equipment

This program will open the doors to Biomedical Electronics, a field of great relevance in of great relevance in society"

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

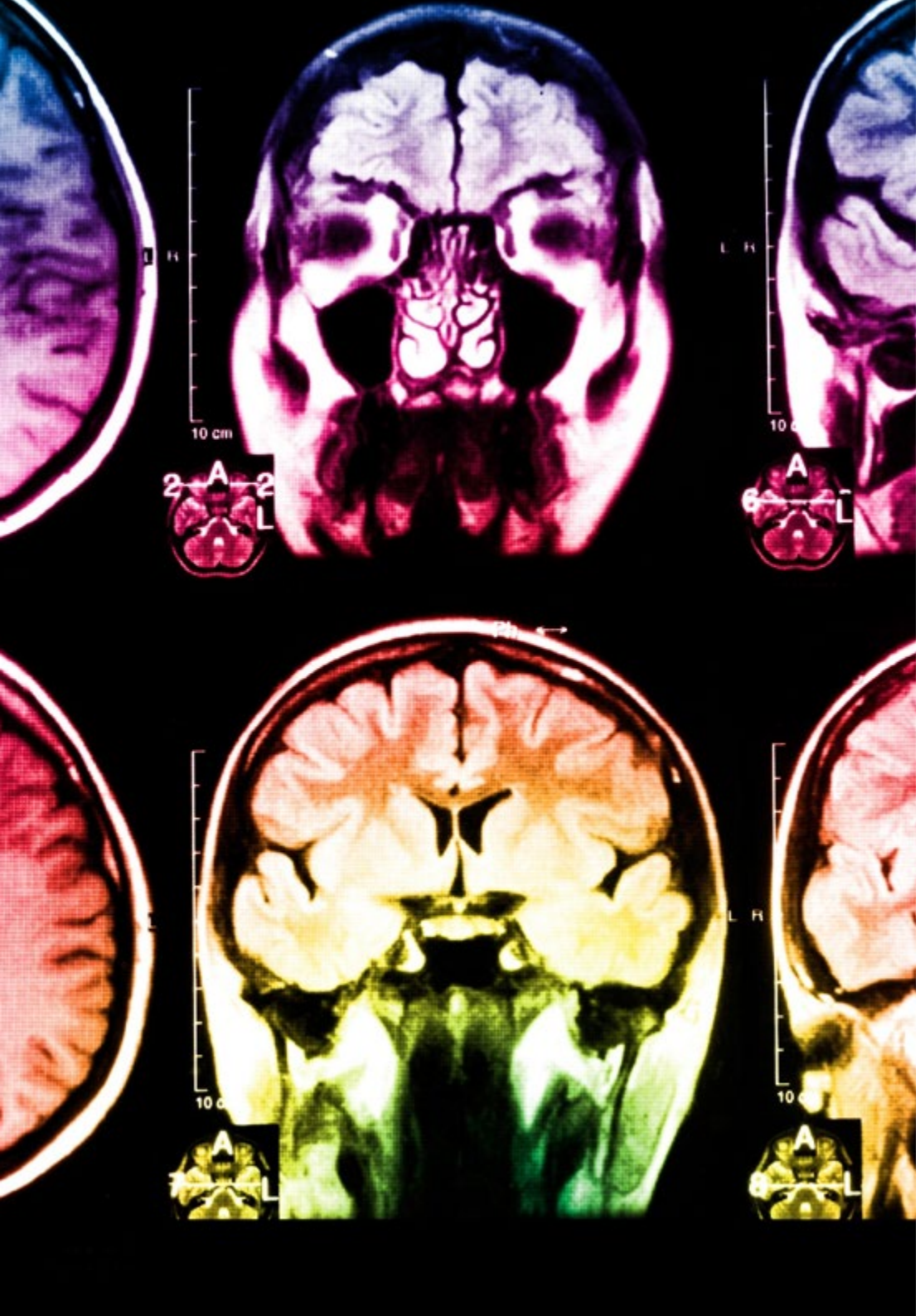
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

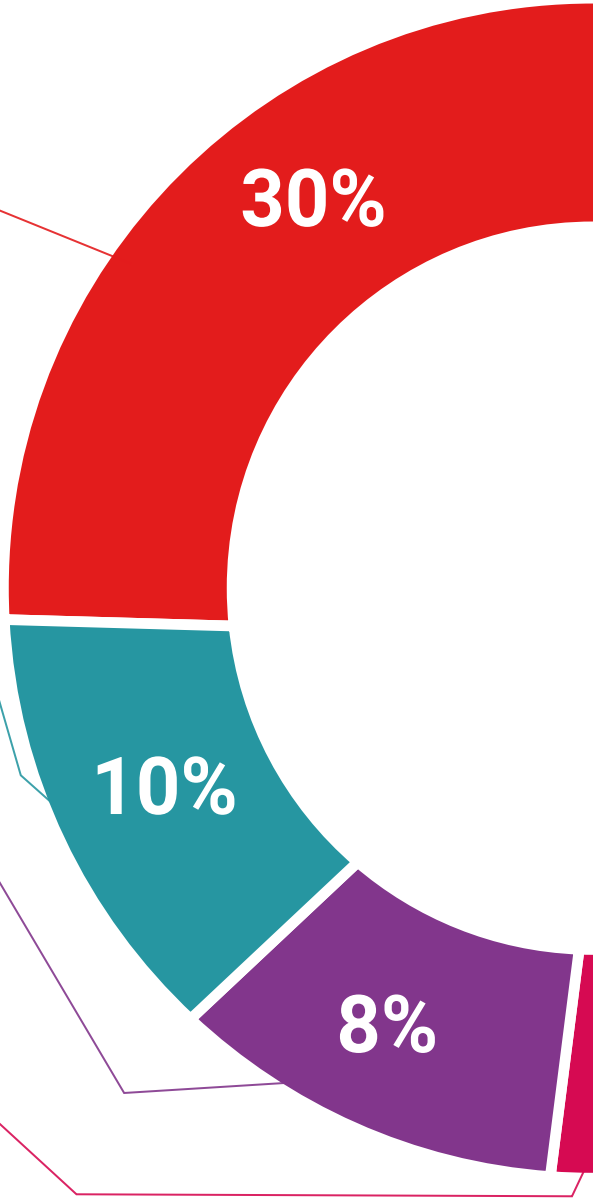
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

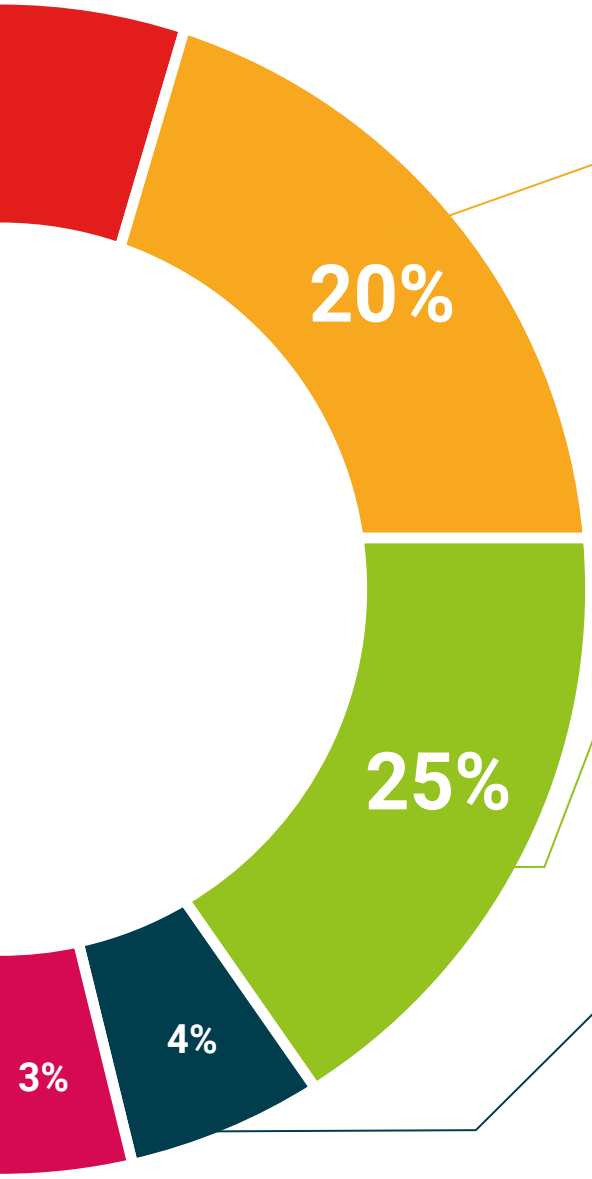
Practising Skills and Abilities

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

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

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

This program will allow you to obtain your **Postgraduate Diploma in Electronics Biomedical** 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.

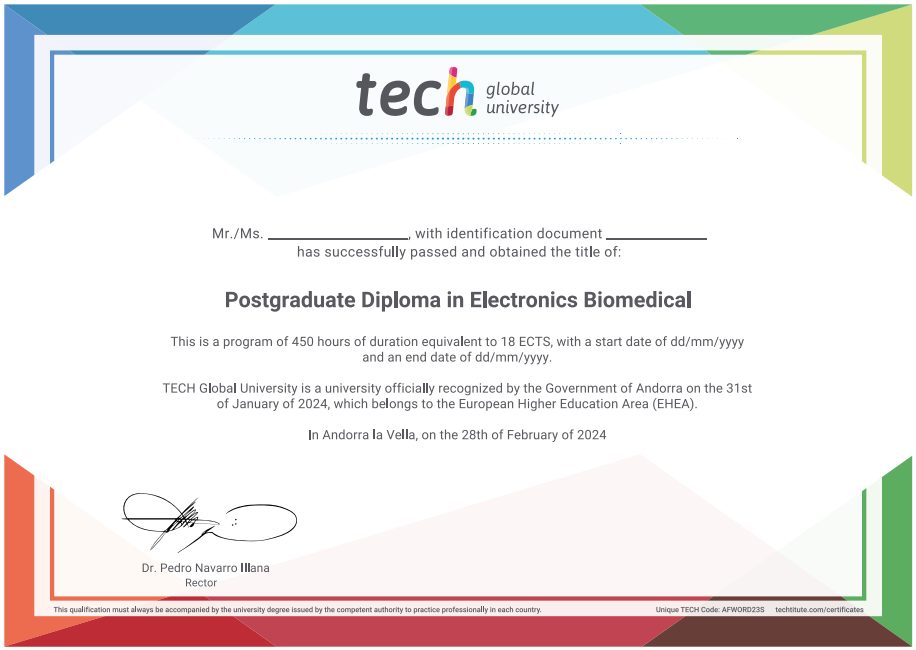
This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Postgraduate Diploma in Electronics Biomedical**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**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Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Postgraduate Diploma in Electronics Biomedical

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
Rector

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

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

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