

# Postgraduate Certificate Biomedical Signal Processing and Analysis



## Postgraduate Certificate Biomedical Signal Processing and Analysis

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

Website: [www.techtitude.com/in/engineering/postgraduate-certificate/biomedical-signal-processing-analysis](http://www.techtitude.com/in/engineering/postgraduate-certificate/biomedical-signal-processing-analysis)

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# 01

# Introduction

The constant and increasingly specific development of Biomedical Signals has been of great help in the field of medical diagnostics, and has become a core research area for engineers and physicians around the world. Correct processing of electrocardiographies, electroencephalographies or magnetoencephalographies can be decisive in providing an accurate diagnosis, which is why it is a field of specialization with great professional prospects. This university program delves into both the theoretical and scientific issues of this field, supported by a faculty composed of professionals with extensive experience and work experience.



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*Deepen and modernize your knowledge of everything related to Biomedical Signals, including signal processing, sampling, filtering and analysis"*



Biomedical Signal Processing and Analysis has been a field that, over the years, has attracted more attention from both engineers and physicians themselves. The many developments in machinery and available technology mean that these two professions must work in close proximity to each other to achieve a high level of professional practice adapted to the greatest challenges.

For any engineering professional who wishes to specialize in this field, it is extremely important to have an up to date range of knowledge. Therefore, an update becomes crucial in the quest for greater professional success. It is for this very reason that TECH has created this program, focused on a complete update on everything related to Biomedical Signal Analysis and Processing.

Moreover, the engineer will not have to sacrifice any aspect of their personal or professional life, as they can adapt the pace of study to their own requirements. The program is 100% online, which means that there are no fixed schedules or established classes. The entire syllabus is available on the virtual campus from day one, which means that it can be downloaded from any device with an Internet connection.

The **Postgraduate Certificate in Biomedical Signal Processing and Analysis** contains the most complete and up-to-date educational program on the market. The most important features include:

- ◆ Case studies presented by experts in Biomedical Engineering
- ◆ 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



*Join one of the most promising branches of engineering research and get up to date on the latest software for Biomedical Signal Processing"*

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*Access a complete and extensive bibliography on Biomedical Signal Processing and Analysis, compiled for both practical and scientific importance”*

The program's teaching staff includes professionals from sector who contribute their work 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 immersive training programmed to train 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 will be able to choose where, when and how to study, giving you the freedom to adapt the study material to your pace and daily responsibilities.*

*Continue to improve your professional career with this comprehensive university program, which will undoubtedly represent a quality boost to your professional profile.*



# 02 Objectives

The objective of this Postgraduate Certificate is precisely to compile the latest scientific knowledge and postulates on Biomedical Signal Processing and Analysis. This makes it, therefore, a solid option with which to build a more prosperous future in this specialty of Biomedical Engineering. Additionally, the professional will have the support of a faculty that has amassed a wealth of experience in the handling and analysis of all types of biomedical tools.





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*Your most ambitious professional goals  
will be much closer after completing  
this Postgraduate Certificate"*



## General Objectives

- ♦ Generate specialized knowledge on the main types of biomedical signals and their uses
- ♦ Develop the physical and mathematical knowledge underlying biomedical signals
- ♦ Fundamentals of the principles governing signal analysis and processing systems
- ♦ Analyze the main applications, trends and lines of research and development in the field of biomedical signals
- ♦ Develop expertise in classical mechanics and fluid mechanics
- ♦ Analyze the general functioning of the motor system and its biological mechanisms
- ♦ Develop models and techniques for the design and prototyping of interfaces based on design methodologies and their evaluation
- ♦ Provide the student with critical skills and tools for interface assessment
- ♦ Explore the interfaces used in pioneering technology in the biomedical sector
- ♦ Analyze the fundamentals of medical imaging acquisition, inferring its social impact
- ♦ Develop specialized knowledge about the operation of the different imaging techniques, understanding the physics behind each modality
- ♦ Identify the usefulness of each method in relation to its characteristic clinical applications
- ♦ Investigate post-processing and management of acquired images
- ♦ Use and design biomedical information management systems
- ♦ Analyze current digital health applications and design biomedical applications in a hospital setting or clinical center





### Specific Objectives

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- ◆ Distinguish the different types of biomedical signals
- ◆ Determine how biomedical signals are acquired, interpreted, analyzed and processed
- ◆ Analyze the clinical applicability of biomedical signals through practical case studies
- ◆ Apply mathematical and physical knowledge to analyze signals
- ◆ Examine the most common signal filtering techniques and how to apply them
- ◆ Develop fundamental engineering knowledge of signals and systems
- ◆ Understand the operation of a biomedical signal processing system
- ◆ Identify the main components of a digital signal processing system

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*You will have the support and backing of the world's largest online academic institution, TECH”*



03

# Course Management

As this is a highly technical engineering specialization that requires a high level of qualification, TECH has enlisted the best possible teachers to develop all the contents of this Postgraduate Certificate. Therefore, with proven and reputed international experience, the professional is assured of access to the highest possible level of educational and complementary material.





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*The best engineers in Biomedicine have meticulously written all the contents of this Postgraduate Certificate, thinking of your professional and academic improvement"*



## Management



### Mr. Ruiz Díez, Carlos

- ♦ Researcher at the National Microelectronics Center of the CSIC
- ♦ Researcher. 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
- ♦ 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)

## Professors

### Mr. Rodríguez Arjona, Antonio

- ♦ Project Manager, Technical Manager and Expert in the Regulation of Medical Devices at Omologic, Homologation and CE Marking
- ♦ Development of the Smart Stent project in collaboration with the TIC-178 research group of the University of Seville
- ♦ Technical Engineer in the Logistics Department of Docriluc, S.L.
- ♦ Digitization Manager at Ear Protech, the in ear experience

- ♦ Computer Technician at the Centro Asociado María Zambrano of the Universidad Nacional de Educación a Distancia (National University of Distance Education)
- ♦ Graduate in Health Engineering with a major in Biomedical Engineering from the University of Malaga
- ♦ Master's Degree in Biomedical Engineering and Digital Health from the University of Seville





04

# Structure and Content

Using TECH's pioneering Relearning methodology, the contents of this Postgraduate Certificate provide the professional engineer with an exhaustive and comprehensive update throughout the program. Delving into topics such as the potential and future of engineering research in all types of diagnostic developments, the engineer will find a clear, concise content aimed especially at their professional improvement.





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*The detailed videos and real case studies will greatly help you to contextualize all the theoretical material"*

## Module 1. Biomedical Signals

- 1.1. Biomedical Signals
  - 1.1.1. Origin of Biomedical Signals
  - 1.1.2. Biomedical Signals
    - 1.1.2.1. Amplitude
    - 1.1.2.2. Period
    - 1.1.2.3. Frequency (F)
    - 1.1.2.4. Wave Length
    - 1.1.2.5. Phase
  - 1.1.3. Classification and Examples of Biomedical Signals
- 1.2. Types of Biomedical Signals Electrocardiography, Electroencephalography and Magnetoencephalography
  - 1.2.1. Electrocardiography (ECG)
  - 1.2.2. Electroencephalography (EEG)
  - 1.2.3. Magnetoencephalography (MEG)
- 1.3. Types of Biomedical Signals Electroneurography and Electromyography
  - 1.3.1. Electroneurography (ENG)
  - 1.3.2. Electromyography (EMG)
  - 1.3.3. Event-Related Potentials (ERPs)
  - 1.3.4. Other Types
- 1.4. Signals and Systems
  - 1.4.1. Signals and Systems
  - 1.4.2. Continuous and Discrete Signals: Analog vs. Digital
  - 1.4.3. Systems in the Time Domain
  - 1.4.4. Systems in the Frequency Domain Spectral Method
- 1.5. Fundamentals of Signals and Systems
  - 1.5.1. Sampling: Nyquist
  - 1.5.2. The Fourier Transform DFT
  - 1.5.3. Stochastic Processes
    - 1.5.3.1. Deterministic vs. Random Signals
    - 1.5.3.2. Types of Stochastic Processes
    - 1.5.3.3. Stationarity
    - 1.5.3.4. Ergodicity
    - 1.5.3.5. Relationships Between Signals
  - 1.5.4. Power Spectral Density
- 1.6. Processing of Biomedical Signals
  - 1.6.1. Processing of Signals
  - 1.6.2. Objectives and Processing Steps
  - 1.6.3. Key Elements of a Digital Processing System
  - 1.6.4. Applications. Trends
- 1.7. Filtering: Artifact Removal
  - 1.7.1. Motivation. Types of Filtering
  - 1.7.2. Time Domain Filtering
  - 1.7.3. Frequency Domain Filtering
  - 1.7.4. Applications and Examples
- 1.8. Time-Frequency Analysis
  - 1.8.1. Motivation
  - 1.8.2. Time-Frequency Plane
  - 1.8.3. Short-Time Fourier Transform (STFT)
  - 1.8.4. Wavelet Transform
  - 1.8.5. Applications and Examples



- 1.9. Event Detection
  - 1.9.1. Case Study I: ECG
  - 1.9.2. Case Study II: EEG
  - 1.9.3. Evaluation of Detection
- 1.10. Software for Biomedical Signal Processing
  - 1.10.1. Applications, Environments and Programming Languages
  - 1.10.2. Libraries and Tools
  - 1.10.3. Practical Applications: Basic Biomedical Signal Processing System



*The interactive summaries  
and work guides created  
by the teachers themselves  
will serve as a fundamental  
support in your study work"*

# 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.





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



## Case Study to contextualize all content

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

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



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



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

### **A learning method that is different and innovative**

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

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

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

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



## Relearning Methodology

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

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

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

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

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



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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



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



#### Study Material

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

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



#### Classes

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

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



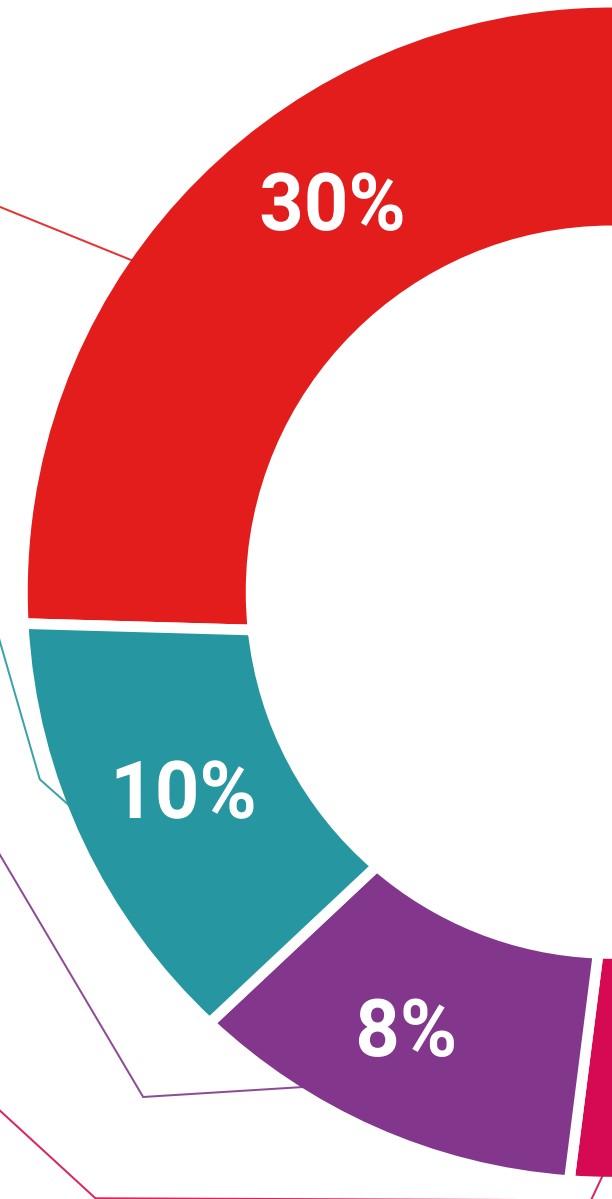
#### Practising Skills and Abilities

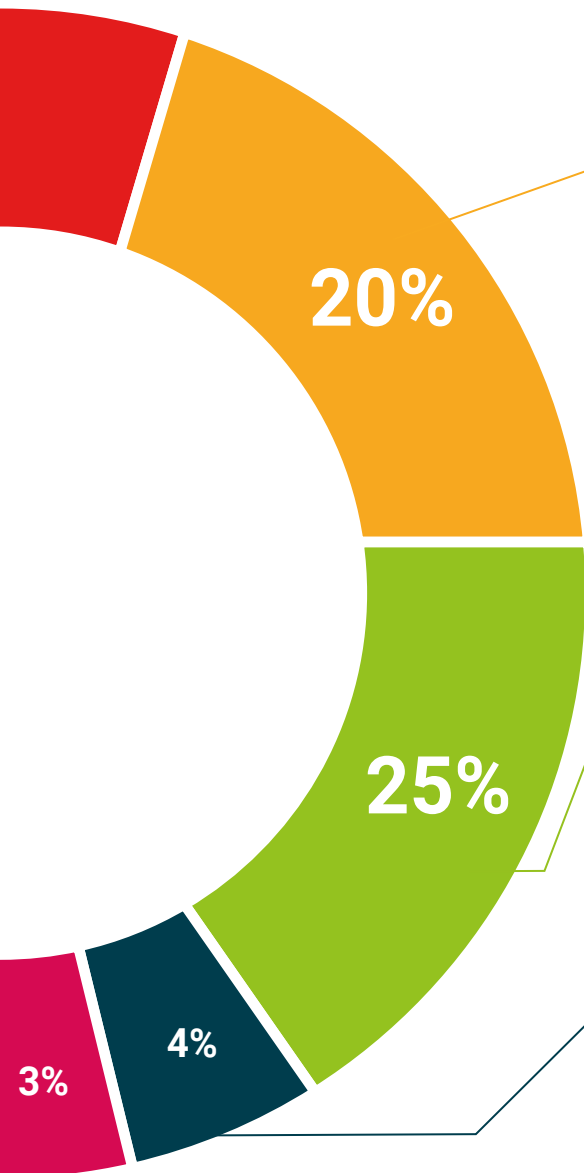
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



#### Additional Reading

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



**Case Studies**

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

**Interactive Summaries**

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

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

**Testing & Retesting**

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





06

# Certificate

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



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

This **Postgraduate Certificate in Biomedical Signal Processing and Analysis** contains the most complete and up to date program on the market.

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

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

Title: **Postgraduate Certificate in Biomedical Signal Processing and Analysis**  
Official N° of hours: 150 h.



\*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.

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



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