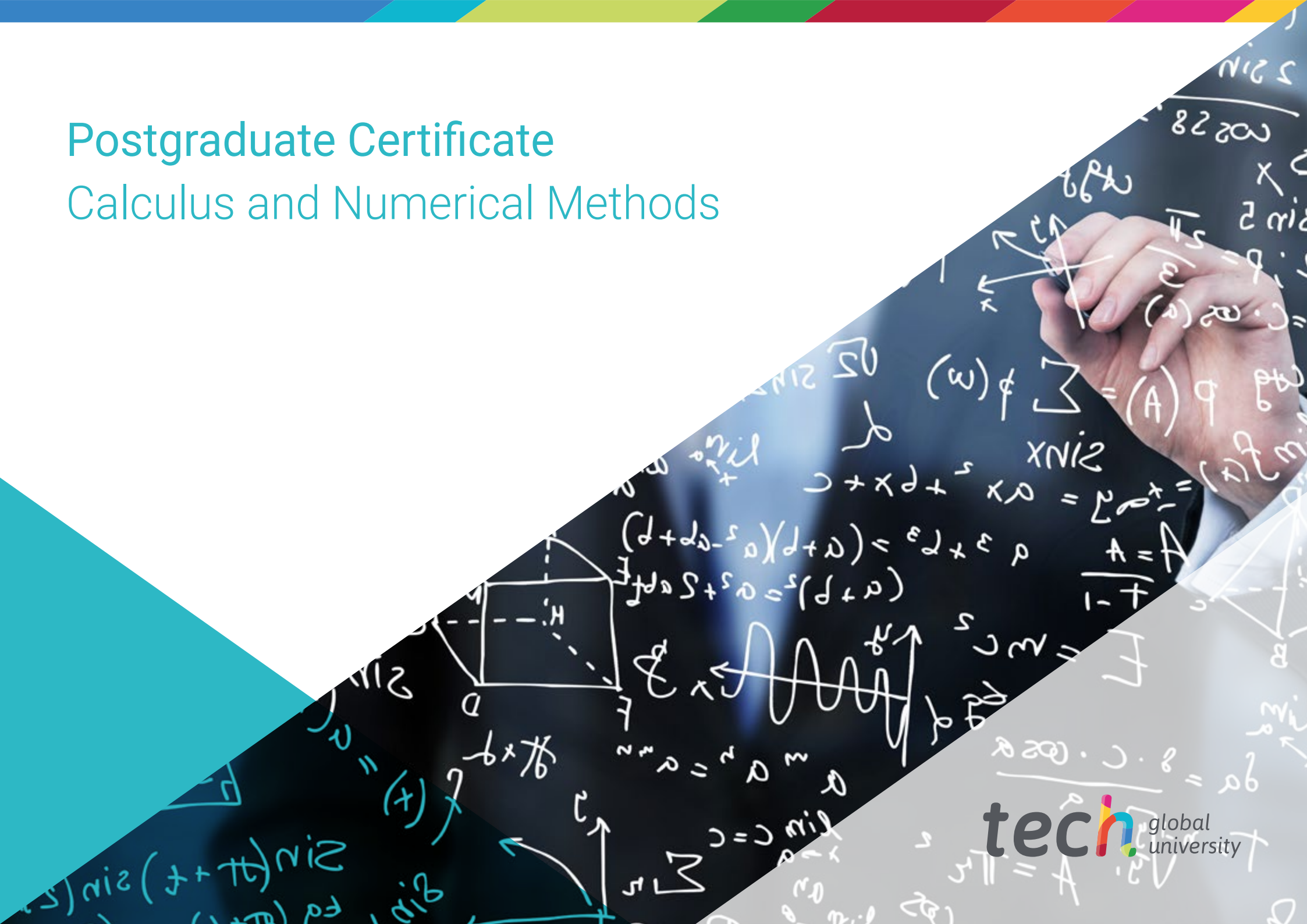


# Postgraduate Certificate

## Calculus and Numerical Methods





## Postgraduate Certificate Calculus and Numerical Methods

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtute.com/us/information-technology/postgraduate-certificate/calculus-numerical-methods](http://www.techtute.com/us/information-technology/postgraduate-certificate/calculus-numerical-methods)

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# 01

# Introduction

The student will be able to specialize in Calculus and Numerical Methods, with this prestigious program developed by professionals with extensive experience in the sector. You will learn the basics of calculus and numerical analysis, starting from the essential concepts such as functions, limits and their calculations, in a practical and 100% online way, with the best didactic resources.





“

*This Postgraduate Certificate will allow you to update your knowledge in Calculus and Numerical Methods in a practical way, 100% online, without giving up the maximum academic accuracy”*

This program is aimed at those interested in achieving a higher level of knowledge in Calculus and Numerical Methods. The main objective is to enable the student to apply in the real world the knowledge acquired in the Postgraduate Certificate, in a work environment that reproduces the conditions that may be encountered in the future, in a rigorous and realistic manner.

This program will prepare scientifically and technologically, as well as to develop the professional practice of software engineering, with a transversal and versatile approach adapted to the new technologies and innovations in this field. You will obtain extensive knowledge in Calculus and Numerical Methods from professionals in the sector.

The students will be able to take the opportunity and study this program in a 100% online format, without neglecting their obligations.

This **Postgraduate Certificate in Calculus and Numerical Methods** contains the most complete and up-to-date program on the market. The most important features include:

- ◆ Development of 100 simulated scenarios presented by experts in Calculus and Numerical Methods
- ◆ Its graphic, schematic and eminently practical contents provide scientific and practical information on Calculus and Numerical Methods
- ◆ News on the latest advances in Calculus and Numerical Methods
- ◆ It contains practical exercises where the self-assessment process can be carried out to improve learning
- ◆ Interactive learning system based on the case method and its application to real practice
- ◆ All of this will be complemented by 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



*Learn the latest techniques and strategies with this program and achieve success as a computer engineer"*

“*Get trained in Calculus and Numerical Methods with this intensive program, from the comfort of your home*”

*Benefit from the latest educational technology to get up to date in Calculus and Numerical Methods without leaving home.*

*Learn the latest techniques in Calculus and Numerical Methods from experts in the field.*

It includes in its teaching staff professionals belonging to the field of education, who bring to this program their work experience, in addition to recognized specialists belonging to reference societies and prestigious universities.

Thanks to its multimedia content developed with the latest educational technology, this Postgraduate Certificate will allow the professional a situated and contextual learning, that is to say, a simulated environment that will provide an immersive learning programmed to learn in real situations.

This program is designed around Problem-Based Learning, whereby the students must try to solve the different professional practice situations that arise throughout the program. For this purpose, the professional will be assisted by an innovative interactive video system created by renowned experts in Calculus and Numerical Methods with extensive teaching experience.



02

# Objectives

The objective of this program is to provide IT professionals with the knowledge and skills necessary to carry out their activity using the most advanced protocols and techniques of the moment. Through a work approach that is totally adaptable to the students, this Postgraduate Certificate will progressively lead them to acquire the competencies that will propel them to a higher professional level.





“

*Achieve the level of knowledge you desire and master the fundamental concepts in Calculus and Numerical Methods with this high-level training"*

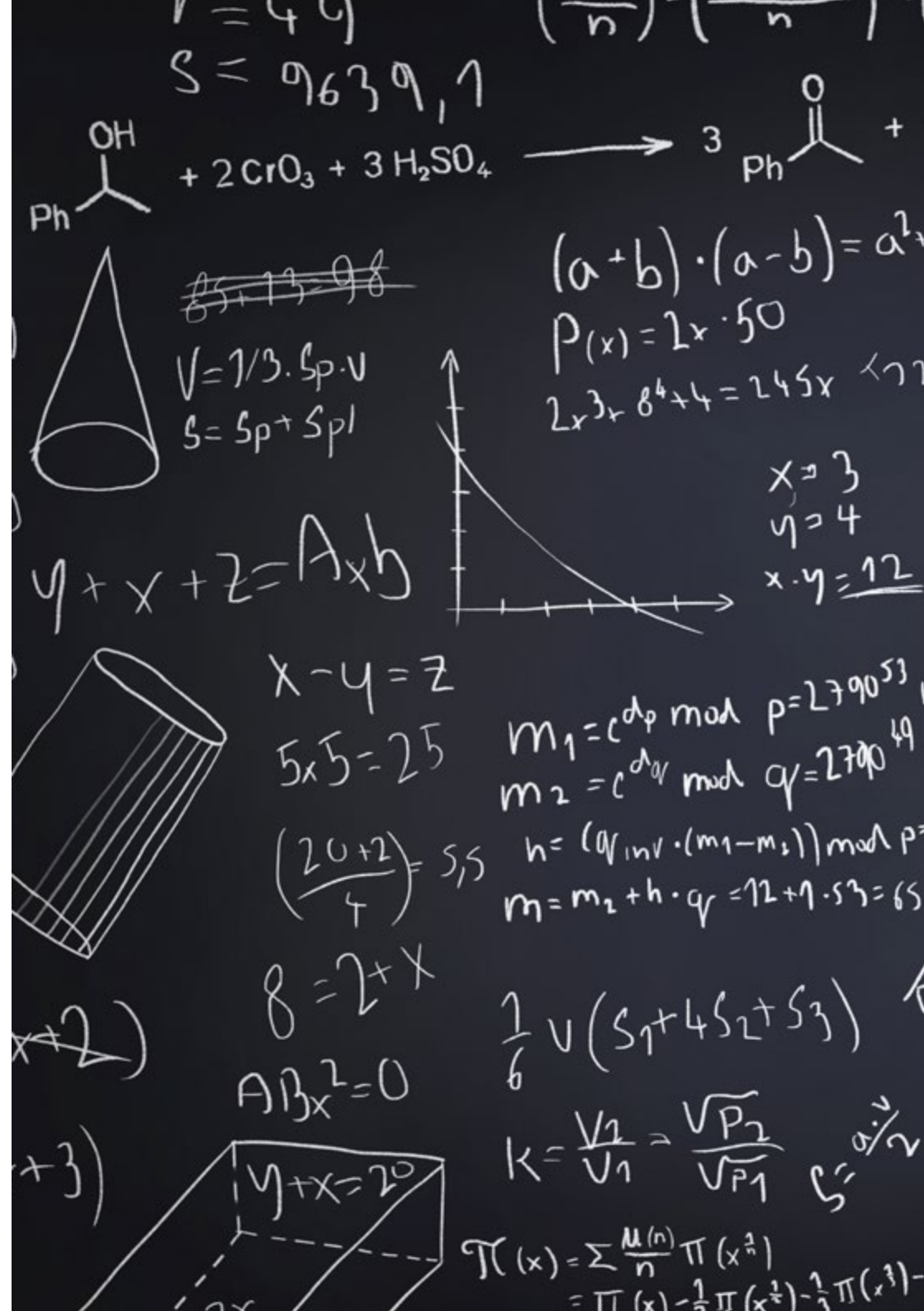


## General Objectives

- ◆ Prepare scientifically and technologically, as well as to develop the professional practice of software engineering, with a transversal and versatile approach adapted to the new technologies and innovations in this field
- ◆ Obtain extensive knowledge in the field of computation, computer structure and in Calculus and Numerical Methods, including the mathematical, statistical and physical basis essential in engineering



Enroll in the best Postgraduate Certificate program in Calculus and Numerical Methods in today's university landscape"





### Specific objectives

- ◆ Establish the basics of calculus and numerical analysis, starting with the essential concepts such as functions, limits and their calculations
- ◆ Assimilate the theory of function derivation and its essential applications, the main interpretations and theorems of derivable functions
- ◆ Understand the behavior of definite and indefinite integrals, knowing the properties of each of them, as well as the main methods and theorems
- ◆ Learn the essential concepts of successions and finite series, as well as the fundamental principles of counting
- ◆ Understand numerical and error analysis, as well as the main existing numbering systems and error propagation
- ◆ Know the main algorithms for root computation and interpolation, as well as resolution and acceleration techniques

Handwritten mathematical notes on a chalkboard:

- $Cr_2(SO_4)_3 + 6H_2O$
- $C_{19}H_{21}ClNNaO_7$
- Chemical structure of a complex organic molecule with a benzene ring, a methyl group, a methoxy group, a carboxylic acid group, and a chlorine atom.
- Legend:  $|||$  - red,  $||||$  - blue,  $○$  - grey
- Equation:  $(\frac{s+2r}{n}) = (\frac{t+at^{-1}+2r}{n}) = (\frac{2(1+a)}{n})$
- System of equations:  $A+B=24$ ,  $B+16=24$
- Volume calculations:  $V = a \times a \times a = a^3$ ,  $V = 6 \times 6 \times 6 = 216$ ,  $V = 216 \text{ cm}^3$ ,  $S = 6 \times a^2$ ,  $S = 6 \times 6^2$ ,  $S = 6 \times 36 = 216 \text{ cm}^2$
- Area of a circle:  $V = \frac{\pi r^2 h}{3}$
- Set theory:  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- Trigonometry:  $\sin(x+y) = \sin x \cdot \cos y + \cos x \cdot \sin y$ ,  $\sin^2 x + \cos^2 x = 1$
- Other notes:  $48 + 12 = 60$ ,  $46 - 3 = 43$ ,  $\frac{1}{5} \pi (x^2)$

# 03

# Structure and Content

The structure of the contents has been designed by a team of Computer Engineering professionals, aware of the relevance of the current specialization in order to deepen in this area of knowledge with the aim of humanistically enriching the student and raising the level of knowledge in Calculus and Numerical Methods by means of the latest educational technologies available.



“

*This Postgraduate Certificate in Calculus and Numerical Methods contains the most complete and up-to-date learning program on the market"*

## Module 1. Calculus and Numerical Methods

- 1.1. Introduction to Analysis
  - 1.1.1. Function Concept
  - 1.1.2. Limit Concept
  - 1.1.3. Limit Calculation
  - 1.1.4. Function Continuity
- 1.2. Derivation of Functions and its Applications
  - 1.2.1. Derivative of a Function
  - 1.2.2. Geometric Interpretation
  - 1.2.3. Physical Interpretation
  - 1.2.4. Derivative Calculation
  - 1.2.5. Successive Derivatives
  - 1.2.6. Derivable Functions Lateral Derivatives
  - 1.2.7. Theorems of Derivable Functions
  - 1.2.8. L'Hôpital Rule
  - 1.2.9. Relative Extremes and Monotony
  - 1.2.10. Inflection Points and Curvature
  - 1.2.11. Optimization Problems
- 1.3. Study and Graphical Representation of One-Variable Functions
  - 1.3.1. Function Study
  - 1.3.2. Polynomial Functions Study
  - 1.3.3. Rational Functions Study
  - 1.3.4. Study of Irrational Functions
  - 1.3.5. Exponential Functions Study
  - 1.3.6. Logarithm Functions Study
  - 1.3.7. Trigonometric Functions Study
  - 1.3.8. Construction of Functions from Other Known Functions
- 1.4. Definite Integral
  - 1.4.1. The Definite Integral as Limit of a Sum
  - 1.4.2. Properties of Definite Integral
  - 1.4.3. Immediate Integrals
  - 1.4.4. Mean Value Theorem of Integral Calculus
  - 1.4.5. Fundamental Theorem of Calculus. Barrow's Rule
  - 1.4.6. Flat Enclosures Areas
  - 1.4.7. Curve Arc Length
  - 1.4.8. Solid Body Volumes
- 1.5. Indefinite Integral
  - 1.5.1. Concept of Primitive of a Function
  - 1.5.2. Properties of Indefinite Integral
  - 1.5.3. Integration by Parts
  - 1.5.4. Rational Functions Integration
  - 1.5.5. Integration by Variable Change
  - 1.5.6. Integration by Trigonometric Substitutions
  - 1.5.7. Non-Elementary Integrals
- 1.6. Finite Sequences and Series
  - 1.6.1. Real Number Sequences
  - 1.6.2. Sets
  - 1.6.3. The Integral Criterion and the Comparison Criterion
  - 1.6.4. Alternating Series
  - 1.6.5. Absolute Convergence and Quotient Criterion
- 1.7. Fundamental Counting Principles
  - 1.7.1. Partitioning of a Set
  - 1.7.2. Addition Principle
  - 1.7.3. Multiplication Principle
  - 1.7.4. Inclusion- Exclusion Principle
  - 1.7.5. Distribution Principle

- 1.8. Numerical and Error Analysis
  - 1.8.1. Origin and Evolution of Numerical Analysis
  - 1.8.2. Algorithms
  - 1.8.3. Error Types
  - 1.8.4. Convergence
- 1.9. Numbering Systems
  - 1.9.1. Information Representation
  - 1.9.2. Introduction to Numerical Systems
  - 1.9.3. Conversion from Decimal System to Base B
  - 1.9.4. Arithmetic Operations in Base B
  - 1.9.5. Conversion from  $b_1$  to  $b_2$  System
  - 1.9.6. Number Representation
  - 1.9.7. Floating Point Arithmetic
  - 1.9.8. Error Propagation
- 1.10. Root Computation and Interpolation, Solving Algorithms and Acceleration Techniques
  - 1.10.1. Bisection Algorithm
  - 1.10.2. Fixed Point Algorithm
  - 1.10.3. Secant Method
  - 1.10.4. Newton-Raphson Algorithm
  - 1.10.5. Modified Secant Algorithm
  - 1.10.6. Modified Newton's Algorithm
  - 1.10.7.  $\Delta^2$  of Aitken
  - 1.10.8. Steffensen's Algorithm



*A unique, key, and decisive educational experience to boost your professional development"*

# 04 Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.







“

*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 we face 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.

With this methodology we have 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, markets, and financial instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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



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



### Study Material

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

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



### Classes

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

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



### Practising Skills and Abilities

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



### Additional Reading

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





#### Case Studies

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



#### Interactive Summaries

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

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



#### Testing & Retesting

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



# 05 Certificate

The Postgraduate Certificate in Calculus and Numerical Methods guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Global University.





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*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 Certificate in Calculus and Numerical Methods** 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 Certificate in Calculus and Numerical Methods**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**





## Postgraduate Certificate Calculus and Numerical Methods

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Global University
- » Credits: 6 ECTS
- » Schedule: at your own pace
- » Exams: online

# Postgraduate Certificate

## Calculus and Numerical Methods