



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus
2026 - 2027

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura	
Subject name	Calculus
Subject code	E000012785
Mainprogram	Bachelor's Degree in Business Analytics
Involved programs	Grado en Análisis de Negocios/Bachelor in Business Analytics y Grado en Relaciones Internacionales [First year] Grado en Análisis de Negocios/Bachelor in Business Analytics y Grado en Derecho [First year] Grado en Análisis de Negocios/Bachelor in Business Analytics [First year] Grado en Admin. y Dirección de Emp. y Grado en Análisis de Negocios/Bachelor in Business Analytics [First year]
Quarter	Semestral
Credits	6,0 ECTS
Type	Básico
Department	Departamento de Métodos Cuantitativos
Coordinator	Luis Ángel Calvo Pascual

Datos del profesorado	
Teacher	
Name	Luis Ángel Calvo Pascual
Department	Departamento de Métodos Cuantitativos
EMail	lcalvo@icai.comillas.edu
Teacher	
Name	Anitha Srinivasan
Department	Departamento de Métodos Cuantitativos
EMail	asrinivasan@icade.comillas.edu
Teacher	
Name	María Teresa Gómez Mendiguchia
Department	Departamento de Métodos Cuantitativos
EMail	mtgmendiguchia@comillas.edu
Teacher	
Name	Pedro Ciller Cutillas
Department	Departamento de Métodos Cuantitativos
EMail	pedro.ciller@comillas.edu
Teacher	
Name	Raquel Galazo García



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus
2026 - 2027

Department	Departamento de Métodos Cuantitativos
E-Mail	rgalazo@comillas.edu

DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

In the professional profile of a Business Analytics graduate, the Calculus course aims to develop key skills, such as the ability to model business and economic problems using differential and integral calculus, analyze and synthesize information in mathematical language, and establish precise quantitative and optimization models. Additionally, this course promotes the resolution of complex problems and optimal decision-making in a business context. The knowledge and competencies acquired by students at the end of the semester will not only be fundamental for their professional development but also serve as a solid foundation for subsequent courses.

Prerrequisitos

Basic knowledge of Calculus in functions of a single variable is assumed, such as solving integrals, derivatives, and limits. In any case, it is recommended to review these materials on the Moodle page *E-learning Comillas PREU-MAT*

Competencias - Objetivos

Competencias

Resultados de Aprendizaje

CN6	Resultados del proceso de Formación y de Aprendizaje: CN6. Conoce las herramientas matemáticas necesarias que les capacite para plantear y resolver los problemas reales planteados derivados del entorno empresarial.
HA6	Resultados del proceso de Formación y de Aprendizaje: HA6. Utiliza las herramientas y técnicas matemáticas más adecuadas a cada problema, implementarlas, interpretar adecuadamente los resultados y sus limitaciones, y comunicarlos a un público no técnico.
CM7	Resultados del proceso de Formación y de Aprendizaje: CM7. Usa herramientas y técnicas matemáticas para dar solución a problemas y toma de decisiones en un entorno de datos masivos tanto cuantitativos como cualitativos, así como es capaz de aprender y trabajar autónomamente en la sociedad de la información.
RA1	CÁLCULO. RA.1 Ser capaz de analizar y sintetizar la información recibida en lenguaje matemático.
RA2	CÁLCULO. RA.2 Modelizar en términos del cálculo diferencial e integral en situaciones dependientes de varias variables.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

Bloque 1: Contenidos de la asignatura

Topic 1: THE DEFINITE INTEGRAL



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus 2026 - 2027

1. Concept of a primitive function.
2. Concept of Riemann Integral.
3. Properties of the Riemann Integral.
4. Integral Function
5. Economic Applications of Integral Theory

Topic 2: FUNCTIONS OF SEVERAL VARIABLES

1. Definition of functions of several variables. Scalar function and vector function.
2. Mathematical domain, economic subdomain, and range.
3. Graph of a scalar function and level curves.
4. Limits and continuity.
5. Directional derivatives. Partial derivatives.
6. Gradient vector. Properties.
7. Applications in economics: marginal magnitudes in economics, marginal rate of substitution.
8. Concept of differential
9. Higher order derivatives. Hessian Matrix.
10. Second differential.
11. Taylor polynomial. Taylor's theorem.

Topic 3: COMPOSITE AND HOMOGENEOUS FUNCTIONS

1. Partial derivatives of composite functions. Chain Rule. Dependency trees.
2. Homogeneous functions. Euler's Theorem. Returns to scale.

Topic 4: INTRODUCTION TO OPTIMIZATION

1. Conceptos de programa y sus tipos. Modelización.
2. Concepto de óptimo y tipos de óptimos.
3. Elementos de topología y teorema de Weierstrass.
4. Resolución gráfica de un programa de optimización.
5. Conjuntos convexos. Definición y caracterización de funciones cóncavas y convexas.

Topic 5: UNCONSTRAINED OPTIMIZATION

1. Unconstrained optimization

Topic 6: OPTIMIZATION WITH CONSTRAINTS

1. Optimization with equality constraints. Lagrange multipliers method.
2. Interpretation of the Lagrange multipliers.
3. Kuhn-Tucker optimization



METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

Metodología Presencial: Actividades

Expository Lessons: The professor will explain the fundamental concepts of each topic, either on the board or using the slides and teaching materials available on Moodle, with particular emphasis on the most relevant aspects.

Problem-Solving in Class: Different types of problems will be solved, explained, and analyzed in class, ranging from basic examples aimed at helping students understand the theory to problems of medium and high complexity. The materials used will be Problem Sets A and B available on Moodle. Expository lessons and problem-solving sessions will be naturally integrated throughout the course.

Computer Practices: Practical computer sessions will be conducted in which students will apply the concepts and techniques studied in the course by solving problems using the MATLAB programming language.

Tutoring: Tutoring will be conducted both in groups and individually. Group tutoring sessions will take place at pre-scheduled times and will be used to resolve general questions concerning the topics covered or the problems included in the corresponding Problem Sets A and B. Individual tutoring will take place during the professor's scheduled office hours.

Continuous Assessment Tests: Two continuous assessment tests will be conducted throughout the semester during regular class hours. The first will be held at the end of Topic 1, and the second after the completion of Topics 2, 3, and 4.

Metodología No presencial: Actividades

Independent Study: Students will independently study the concepts presented in the expository lessons, as well as the problems and MATLAB practical exercises.

As an additional learning resource, students will have access to **short audiovisual learning modules** of approximately 10 minutes each. A total of eight videos will be provided, covering the main concepts and representative examples from each topic.

RESUMEN HORAS DE TRABAJO DEL ALUMNO

CLASSROOM HOURS	
Lecciones de carácter expositivo	Sesiones tutoriales
56.00	4.00
NON-PRESENTIAL HOURS	
Estudio y lectura organizada	Ejercicios y resolución de casos y de problemas
40.00	50.00
ECTS CREDITS: 6,0 (150,00 hours)	

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

The use of AI to produce full assignments or substantial parts thereof, without proper citation of the source or tool used, or without explicit permission in the assignment instructions, will be considered plagiarism and therefore subject to the University's General Regulations.



Evaluation activities	Evaluation criteria	Weight
Final Exam	• Understanding of concepts. • Application of concepts, techniques, and procedures to solve practical problems. • Analysis and interpretation of the results obtained in problem-solving. • Presentation and written communication.	70
There will be 2 throughout the semester.	• Understanding of concepts. • Application of concepts, techniques, and procedures to solve practical problems. • Analysis and interpretation of the results obtained in problem-solving. • Presentation and written communication.	30 %

Calificaciones

Ordinary Examination Session

The student's grade in the ordinary examination session of the course, provided that they achieve a minimum score of 4.25 points in the final exam of the same will be:

- 70% of the grade will be the score obtained in the final exam of the course.
- 30% of the grade will be the average score of the monitoring tests carried out throughout the semester.

Observation: If the score obtained in the final exam of the course is less than 4.25 points, the student's grade will be the score obtained in that exam.

Extraordinary Examination Session:

- If the student obtains a grade of **4.25 or higher** in the extraordinary examination, the final course grade will be the higher of the following two options:
 - **Option A:** Extraordinary examination (100%).
 - **Option B:** Extraordinary examination (65%) and continuous assessment grades (35%).
- If the student obtains a grade **below 4.25** in the extraordinary examination, the final course grade will be the grade obtained in that examination.

Course Regulations

Failure to attend classes, under the conditions established in the academic regulations of each Faculty, may result in the student not being allowed to sit the examination in the ordinary examination session.

If a student is unable to take a continuous assessment test, a make-up test will only be offered if the absence is duly justified on the grounds of illness or another serious circumstance. Otherwise, the student will receive a grade of 0 for that test. Students with a justified absence must accept the date proposed by the professor for a special examination prepared for such cases.



If a student repeatedly behaves inappropriately in class, this may result in penalties to their final grade, disciplinary proceedings being initiated by the Academic Affairs Office, or other measures as appropriate.

Use of Artificial Intelligence

Professors will encourage the responsible and critical use of artificial intelligence tools, including generative AI tools and prompting techniques, to support independent study and the understanding of concepts.

However, the use of such tools, including **AI assistants in MATLAB**, is **strictly prohibited during examinations and continuous assessment activities**. Any use of these tools in such circumstances will be considered a serious breach of the academic regulations.

PLAN DE TRABAJO Y CRONOGRAMA

Activities		Date of realization	Delivery date
Week	Topics		
1	Topic 0: Functions of one variable		
	Topic 1: Integrals		
2	Topic 1: Integrals		
3	Partial exam: Topics 0 and 1		
	Topic 2: Functions of several variables		
4	Topic 2: Functions of several variables		
5	Topic 2: Functions of several variables		
6	Topic 2: Functions of several variables		
7	Topic 2: Functions of several variables		
	Partial exam Topic 2		
8	Topic 3: Composite and Homogeneous Functions		
9	Topic 4: Introduction to optimización		
10	Topic 4: Introduction to optimización		
11	Topic 5: Unconstrained optimization		
12	Topic 5: Unconstrained optimization		
	Partial exam Topics 3, 4 y 5		
13	Topic 6: Constrained optimization		
14	Topic 6: Constrained optimization		

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

- Sydsaeter, K., Hammond, P. J., Matemáticas para el análisis económico. Prentice Hall, 1999
- Anthony, M., Biggs, N., Mathematics for economics and finance. Methods and modelling. Cambridge University Press, 1996
- Giménez Abad, M^a J., Martín Antón, G. y Serrano Rey, A.: Matemáticas para ADE. Teoría y ejercicios. Editorial Pearson. Madrid 2020



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus 2026 - 2027

Bibliografía Complementaria

- García, A., López, A., Romero, S., Rodríguez, G., Villa, A. de la. Calculo II: Teoría y problemas de funciones de varias variables (2ª edición). CLAG, 2006.
- Martínez Estudillo, F.J., Introducción a las matemáticas para la economía. Desclée De Brouwer, S.A., 2005