



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus
2026 - 2027

TECHNICAL SHEET OF THE SUBJECT

Data of the subject	
Subject name	Business Mathematics II
Subject code	E000011445
Main program	Bachelor's Degree in Business Administration and Management
Involved programs	Grado en Administración y Dirección de Empresas (E-2) [First year] Grado en Administración y Dirección de Empresas y Grado en Derecho [First year] Grado en Administración y Dirección de Empresas con Mención en Internacional (E-4) [First year] Grado en Administración y Dirección de Empresas y Grado en Relaciones Internacionales [First year] Grado en Administración y Dirección de Empresas (E-2) - en inglés [First year] Grado en Gastronomía e Innovación Culinaria y Grado en Administración y Dirección de Empresas [First year] Grado en Psicología y Grado en Administración y Dirección de Empresas [First year] Grado en Psicología + Grado en Administración y Dirección de Empresas [First year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	6,0 ECTS
Type	Básico
Department	Departamento de Métodos Cuantitativos
Coordinator	GLORIA MARTIN ANTÓN

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SPECIFIC DATA OF THE SUBJECT

Contextualization of the subject
Contribution to the professional profile of the degree
A student that obtains the Degree in Business Administration needs to develop the ability for abstract thoughts in the business world. A quantitative modeling skill and the use of a formal language, that are essential to develop these skills, are largely provided
Prerequisites
None. Students are encouraged to use the videos from the PREUMAT course, which are available to them through Moodle.



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Competencies - Objectives

Competences

GENERALES

CG1	Adquirir una base de conocimientos sólida y relevante sobre la disciplina científica y empresarial	
	RA1	Capacidad de expresarse en lenguaje matemático
	RA2	Capacidad de utilización de las matemáticas en otras materias del grado
CG14	Capacidad para aprender y trabajar autónomamente.	
	RA1	Desarrolla habilidades necesarias para el estudio e investigación independiente
	RA2	Encuentra por sí mismo aplicaciones y extensiones de los conceptos y metodologías estudiadas
CG2	Capacidad de gestionar información y datos provenientes de fuentes diversas para hacer un análisis crítico y un correcto diagnóstico de la realidad empresarial.	
	RA1	Capacidad para la formulación en lenguaje matemático de los problemas que surgen en la gestión empresarial y de la resolución de los mismos.

ESPECÍFICAS

CE8	Conocimiento de técnicas matemáticas que permiten modelizar y resolver problemas en el ámbito económico-empresarial	
	RA1	Ante un enunciado de un problema empresarial es capaz de utilizar los instrumentos matemáticos que mejor representan el problema.
	RA2	Apoyándose en el análisis gráfico, verbal y los datos cuantitativos y cualitativos es capaz de integrarlos en modelos gradualmente más complejos.
	RA3	Es capaz de aplicar correctamente a los problemas empresariales el álgebra lineal, análisis funcional, cálculo integral y búsqueda de óptimos.

THEMATIC BLOCKS AND CONTENTS

Contents - Thematic Blocks

BLOQUE I: FUNCTIONS OF SEVERAL VARIABLES

TOPIC 1: FUNCTIONS OF SEVERAL VARIABLES I

1.1 Definition of function of several variables. Domain and Range.

1.2 Graphical representation. Level curves.

1.3 Limits and continuity



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1.4 Directional derivatives. Partial derivatives.

1.5 Gradient. Properties.

1.6 Higher order derivatives. Hessian matrix.

1.8 Taylor polynomial. Taylor's theorem

TOPIC 2: FUNCTIONS OF SEVERAL VARIABLES II

2.1 Several variable function composition. Chain rule

2.2 Homogeneous functions. Euler's theorem of homogeneous functions.

BLOQUE II: OPTIMIZATION THEORY

TOPIC 3: INTRODUCTION TO OPTIMIZACIÓN

3.1 Optimization programs. Modeling.

3.2 Optimal points.

3.3 Graphical resolution of an optimization program.

3.4 Elements of Topology.

3.5 Theorem of Weierstrass.

TOPIC 4: CONVEXITY ANALYSIS

4.1 Convex sets and properties.

4.2 Concave and convex functions. Properties.

4.3 Characterization of convexity for class C^1 functions.

4.4 Characterization of convexity for class C^2 functions.

4.5 Convex programs. Local-Global Theorem.

TOPIC 5: UNCONSTRAINED OPTIMIZATION

5.1 Necessary condition

5.2 Sufficient condition

5.3 Sufficiency of the necessary condition

TOPIC 6: CONSTRAINED OPTIMIZATION

6.1 Types of constrained optimization programs.

6.2 Optimization with equality restrictions.



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6.3 Implicit Functions. Existence Theorem.

6.4 Lagrange multipliers method.

6.5 Sufficient condition of local optimum.

6.6 Lagrange multiplier interpretation.

6.7 Optimization with inequality constraints, Kuhn-Tucker conditions

TEACHING METHODOLOGY

General methodological aspects of the subject

In-class Methodology: Activities

Expository lectures

General content presentation sessions

Public presentations of topics and works

Exercises and problem resolution

CG1, CG2, CG14, CE8

Non-Presential Methodology: Activities

Tutorial sessions

Learning in groups

CG1, CG2, CG14, CE8

SUMMARY STUDENT WORKING HOURS

CLASSROOM HOURS		
Lecciones de carácter expositivo	Ejercicios y resolución de casos y de problemas	Sesiones tutoriales
34.00	20.00	16.00
NON-PRESENTIAL HOURS		
Sesiones tutoriales	Estudio individual y/o en grupo y lectura organizada	
12.00	78.00	
ECTS CREDITS: 6,0 (160,00 hours)		

EVALUATION AND CRITERIA

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
WRITTEN EXAM: - With theory and problems - Assessment will be based on students' reasoning skills and their mastery of the course concepts	- Same Criteria for all students of the course. - In order to carry out the weighted average between the final grade and the tests, it is necessary to obtain, at least, 4 over 10 in the Final Exam.	70 %
CONTINUOUS EVALUATION: WRITTEN EXAMS 1st exam on Unit 1 2nd exam on Unit 2, Unit 3 and Unit 4 3rd exam: average of around 4 Quizzes PRESENTIAL AND NON ACTIVITIES	- A 25% will be obtained from the average about three partial exams - A positive valuation of 5% will be weighted on presential activities mentioned in the qualification part	30 %

Ratings

EVALUATION SYSTEM

FINAL EXAM: 70% WRITTEN

Written assessments: 25%, based on the average of the following three marks:

- Mark obtained in Written Test 1: Topic 1
- Mark obtained in Written Test 2: Topics 2 , 3 y 4
- Average mark obtained from the four in-class quizzes

PRESENTIAL ACTIVITIES: a additional valuation 5% over of the grade is given by the teacher for the completion of the following activities:

- Weekly Quiz
- Class participation.
- Attendance to individual and group tutorials
- Expositions on the blackboard
- Proposed voluntary works
- MatLab exercises
- Critical way of using AI

FINAL CONSIDERATIONS:



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- Any student action aimed at obtaining a higher grade fraudulently will result in a score of zero for the corresponding assessment tool, without prejudice to any disciplinary consequences that may arise.
- If artificial intelligence tools are used in any submission, it is necessary to clearly state that such tools were used. The resulting product must not be mistaken for the student's own work in order to avoid being considered a fraudulent action. The use of AI will be strictly prohibited in any exam or continuous assessment test.
- Using AI to create complete assignments or significant parts of them without citing the source or the tool, or without explicit permission in the assignment description, will be considered plagiarism and will be regulated in accordance with the University's General Regulations.
- Failure to attend class, according to the academic rules of each Faculty, may result in the student being unable to sit for the ordinary exam.
- If a student cannot take a test, it can only be rescheduled with a medical certificate or other relevant documentation. If the absence is not justifiable—due to illness or a serious incident—the test will not be rescheduled.
- Exams can only be rescheduled in the case of a serious, justified cause and will always take place with all students in similar situations on a Friday afternoon.

EXTRAORDINARY

- The final califications will be the best of the these two options: 70% exam + 30% the rest or 100% the exam.

BIBLIOGRAPHY AND RESOURCES

Basic Bibliography

Giménez Abad, M^a J., Martín Antón, G. y Serrano Rey, A.: Matemáticas para ADE. Teoría y ejercicios. Editorial Pearson. Madrid 2020

Complementary Bibliography

Martínez Estudillo, Francisco J.: "Introducción a las Matemáticas para la Economía". Editorial DDB. 2005

Sydsaeter, K. y Hammond, P.J.: "Matemáticas para el análisis económico". Editorial Prentice Hall. 1999

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E-LERANING PREU-MAT