



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus
2024 - 2025

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 (E-2)
Involved programs	Grado en Administración y Dirección de Empresas (E-2) [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) - Bilingüe en inglés [First year] Grado en Psicología y 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. It could be advisable for students to take the Mathematics Course offered at the Pre-University Campus

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 I

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

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 Weiestrass.

TOPIC 4: CONVEXITY ANALYSIS

- 4.1 Convex sets and properties.
- 4.2 Concave and convex functions. Properties.
- 4.3 Characterization of convexity for class C1 functions.
- 4.4 Characterization of convexity for class C2 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.
- 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

Evaluation activities	Evaluation criteria	Weight
WRITTEN EXAM: with theory and problems	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 1st exam on Unit 1 2nd exam on Unit 2 and Unit 3 3rd exam on Units 4 and 5 	A 25% will be obtained from the average about three partial examns A positive valuation of 5% will be weighted on	30 %



PRESENTIAL AND NON ACTIVITIES

presential activities mentioned in the qualification part

Ratings

EVAUVALUATION SYSTEM

FINAL EXAM: 70% WRITTEN

EXAMS: 25% of the average obtained with the mark of the first exam and the better of remaining two exams

- Exam 1: on Unit 1
- Exam 2: on Unit 2 and Unit 3
- Exam 3: on Units 4 and 5

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

- Class participation.
- Attendance to individual and group tutorials
- Expositions on the blackboard
- Proposed voluntary works
- Weekly Quiz

FINAL CONSIDERATIONS:

- 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.
- *If a student cannot take an exam at the given time, it will not be repeated. It is only possible to recover the exam with a justification for a serious cause and it will always be done with all classmates in a similar situation on a Friday afternoon
- Use of fraudulent means used will result in a 0 in the corresponding activity. Furthermore, the student may be subject to disciplinary action.
- Use of any artificial intelligence tools should be clearly stated so as not to be mistaken as work done by the student. In the lack of such clarification the work may be subject to consideration as fraudulent.
- Failure to attend classes according to the regulations set by each faculty may result in the student not being allowed to take the final exam.

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



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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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