COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

TEACHING GUIDE
2023 - 2024

COURSE DATA SHEET

Course Data	
Full Name	Álgebra/Algebra
Code	E000012781
Taught in	Bachelor in Business Analytics & Bachelor in International Relations [First Year] Bachelor in Business Analytics & Bachelor in Law [First Year] Bachelor in Business Analytics [First Year] Bachelor in Business Administration and Management & Bachelor in Business Analytics [First Year]
Level	Regulated European Degree
Duration	Half Yearly
Credits	6,0 ECTS
Character	Mandatory (Bachelor)
Department / Area	Department of Quantitative Methods
Person in Charge	David Roch Dupré
Office Hours	Students will be informed on the first day of class.

Faculty Data	
Professor	
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Professor	
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SUBJECT SPECIFIC DATA

Contextualization of the subject

Contribution to the professional profile of the degree

A graduate in Business Analytics must use data and analytical techniques to improve business decision making. Thus, he/she must be able to abstract the essence of each problem in order to use the most appropriate analytical method to solve it. Algebra will provide students with skills that will help them in these tasks, because it will foster the ability to abstract and because it is the basis of many mathematical processes that they will have to use in the future.

Prerequisites

None. It would be advisable for students to have taken the Mathematics course offered at the Pre-University Campus.

Competencies - Objectives

Competencies

General Competencies

CG02 Ability to analyze massive data from different sources: text, audio, numerical and image.
RA1 Being able to analyze and synthesize the information received in mathematical language.
CG03 Problem solving and decision making in an environment of massive quantitative and qualitative data.
RA1 To know the basic mathematical tools that enable them to pose and solve real problems in the business world.
RA2 Acquire the ability to make decisions with knowledge, initiative and critical spirit.
CG09 Ethical commitment in the information society.
RA1 Pursue excellence in professional actions.
CG11 Ability to learn and work autonomously in the information society.
RA1 Be able to apply the knowledge obtained in new contexts.
RA2 Be able to learn new methods and theories autonomously in their professional life.

Specific Competencies

CE17 To acquire the ability to solve problems posed in the business environment using mathematical tools.
RA1 To know the basic tools of linear algebra.

Learning Outcomes

Included in the previous section, as they are associated with the competencies.

CONTENTS

CONTENT

Unit 0: Matrices

1. Introductory example
2. Matrices. Basic types
3. Operations with matrices
4. Square matrices
5. Range of a matrix

Unit 1: Systems of Linear Equations

1. Introductory example
2. Systems of linear equations
3. Types of systems according to their solution
4. Rouché-Frobenius Theorem
5. Solving systems of linear equations

Unit 2: Vector Spaces

1. Introductory example
2. Definition of (Real) Vector Space (VE)
3. Linear combination of vectors. Linear Variety
4. Generating system of an EV
5. Linearly dependent/independent vectors
6. Basis of an EV. Dimension of an EV. Change of basis in an EV
7. Vector subspace (VSS)

Unit 3: Linear Maps

1. Definition of linear map
2. Matrix expression of a linear map
3. Change of basis in a linear map

Unit 4: Endomorphisms and Diagonalization

1. Eigenvalues and eigenvectors. Determination and important theorems
2. Diagonalization of an endomorphism
3. Applications of diagonalization of endomorphisms.
4. Diagonalization of symmetric matrices

Unit 5: Quadratic Forms

1. Definition of quadratic form. Matrix expression.
2. Sign of a quadratic form.
3. Study of the sign of a quadratic form through eigenvalues.
4. Study of the sign of a quadratic form through principal minors.
5. Restricted quadratic forms.

TEACHING METHODOLOGY

General methodological aspects of the course

Face-to-Face Methodology: Activities

Expository sessions always combining theory and solving exercises as an application of that theory.

Laboratories. There is only one preset session initially. As the classes develop, laboratories and computer practices will be incorporated in the classroom. Therefore, students will be asked to bring their computers to class.

Non-attendance Methodology: Activities

Tutorial sessions

Learning in groups of students

r of proposed exercises for personal study

SUMMARY OF STUDENT WORKING HOURS

Lessons:

- Lectures: 58 h
- Practical Seminars: 2h

Individual Work:

- Individual and/or group study and organized reading: 90 h

ECTS CREDITS: 6 (150 hours)

EVALUATION AND GRADING CRITERIA

Midterm Texts

- Two midterm tests throughout the course to motivate the student in his study and allow him to be aware of his performance.
- One or two short (15-minute) quizzes to ensure basic content knowledge.

Unexcused absence from any of the tests will result in a “zero”.

Final Exam

It will contain questions of different types:

1. Theory exercises
2. Exercises to be solved with a computer

Grades

Ordinary Examination:

Weighted average: final exam (70%) and continuous evaluation grades (30%).

Extraordinary Examination:

Best option from the following:

- Option a: final exam (100%)
- Option b: final exam (70%) and continuous evaluation grades (30%).

WORK PLAN AND SCHEDULE

Activities	Date	Delivery Date
Unit 0: Matrices MatLab Introduction and Installation	Week 1	
Unit 0: Matrices Unit 1: Linear systems of equations	Week 2	
Unit 1: Linear systems of equations Unit 2: Vector spaces I	Week 3	
Test Units 0 - 1 Unit 2: Vector Spaces I	Week 4	
Unit 2: Vector Spaces II	Week 5	
Unit 2: Vector Spaces II	Week 6	
Unit 2: Vector Spaces III	Week 7	
Test Unit 2 Unit 3: Linear Maps	Week 8	
Unit 3: Linear Maps	Week 9	

Unit 4: Diagonalization	Week 10	
Unit 4: Diagonalization	Week 11	
Unit 4: Diagonalization	Week 12	
Unit 5: Quadratic forms	Week 13	
Unit 5: Quadratic forms	Week 14	

BIBLIOGRAPHY

Basic Bibliography

- Giménez Abad, Mª J., Martín Antón, G. y Serrano Rey, A.: Matemáticas para ADE: Teoría y Ejercicios. Editorial Pearson. 2014
- De la Villa, A. (2010) Problemas de álgebra. Ed. CLAGSA. Madrid

Complementary Bibliography

Lay, D. C. (2003). *Linear algebra and its applications*. Pearson Education India.