Universitat Autònoma de Barcelona

2020/2021

Mathematics II

Code: 102096
ECTS Credits: 6

Degree	Type	Year	Semester
2501231 Accounting and Finance	FB	1	2
2501232 Business and Information Technology	FB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: Yes

Teachers

Maria Beatriz Quiros Blasco
Walter Andrés Ortiz Vargas
Mercedes Donaire Benito

Prerequisites

To follow properly this course, a correct understanding of basic mathematical concepts and tools is necessary, including the fundamental notions of continuity, differentiability, and graphical representation of real functions of one real variable, as studied in Mathematics I.

Objectives and Contextualisation

This course introduces students to the study of linear algebra and functions of several variables, with emphasis on their applications in economics. Students should not only acquire and assimilate new mathematical knowledge, but also be able to apply them in quantitative analysis in economics and business.
Therefore, the purpose of the course is that students become familiar with basic mathematical concepts to be used in the study of economic theory and analysis.

Specifically the objectives are intended to achieve are:

1. To familiarize students with the n-dimensional Euclidean space.
2. Working with determinants and matrices.
3. Solving systems of linear equations.
4. Understanding the functions of several variables and their role in more complex economic models.
5. Geometric representation of functions of two variables using contour maps.
6. Understand the concepts of limit of a function at a point and of a continuous function.
7. Understanding the Weierstrass theorem.

8. To familiarize students with the partial derivatives of functions of several variables and the concept of differentiability.
9. Using partial derivatives to obtain the slope of the contour at one point and to perform comparative statics exercises.
10. Solving optimization problems without constraints and with equality constraints.

Competences

Accounting and Finance

- Analysing, summarising and assessing information.
- Interpreting and using mathematical tools and statistics in order to identify and solve problems of the economical and business scope with deterministic or/and random components.
- Organising the work, regarding order and planning.
- Working effectively in teams.

Business and Information Technology

- Developing self-learning strategies.
- Interpreting and using mathematical and statistic tools in order to identify and solve problems of the economical and business scope with deterministic or/and random components.
- Students must be capable of analysing, summarising, organising, planning and solving problems and making decisions.
- Working in teams, sharing knowledge and communicating it to the rest of the team and the organisation.

Learning Outcomes

1. Analysing, summarising and assessing information.
2. Analytically formulating and solving optimization problems in the field of economy and business.
3. Applying the theorems of an inverse function and implicit function to concrete problems.
4. Applying the theorems of the inverse function and the implicit function to concrete problems.
5. Developing self-learning strategies.
6. Discussing and solving systems of linear equations.
7. Doing operations with matrices and calculating determinants.
8. Naming basic results from the differential calculus in various real variables.
9. Naming basic results of Differential Calculus in various real variables.
10. Organising the work, regarding order and planning.
11. Students must be capable of analysing, summarising, organising, planning and solving problems and making decisions.
12. Working effectively in teams.
13. Working in teams, sharing knowledge and communicating it to the rest of the team and the organisation.

Content

PART I. LINEAR ALGEBRA

Topic 1. ALGEBRA OF VECTORS AND MATRICES

1.1. Systems of linear equations

1.2 Operations with arrays and vectors

1.2. Linear dependence and independence of vectors

1.3. Properties of basic operations and geometric interpretations

1.4. Euclidean norm and distance

1.5. Sets, lines and planes

Topic 2. MATRIX CALCULATIONS

2.1. Matrices, determinants, inverse matrices, and rank

2.2. Solving systems of equations using matrices

PART II. FUNCTIONS OF MANY VARIABLES

Topic 3. STUDY OF FUNCTIONS OF MANY VARIABLES

3.1. Characteristics of functions of several variables

3.2. Geometric representation

3.3. Surfaces and distances

3.4. Level curves

Topic 4. PARTIAL DERIVATIVES AND DIFFERENTIABLE FUNCTIONS

4.1. Derivative of a function at a point in the direction of a unit vector

4.2. Partial derivatives

4.3. Gradient of a function at a point. Geometric interpretation and directional derivatives

4.4. Differentiable functions. Continuity of partial derivatives

4.5. Chain rule

4.6 Partial derivatives of linear combinations and of quadratic forms

4.7 First and second order Taylor series approximations

Topic 5. IMPLICIT FUNCTION THEOREM AND INVERSE FUNCTION THEOREM

5.1. Implicit function theorem

5.2. Inverse function theorem

5.3. Geometric applications and intuition

PART III. OPTIMIZATION WITH MULTIPLE VARIABLES

Topic 6. UNRESTRICTED OPTIMIZATION

6.1. Local and global optima

6.2. First and second order conditions for local optima

6.3. Global optima of concave and convex functions

Topic 7. OPTIMIZATION WITH RESTRICTIONS

7.1. Maximization and minimization with equality constraints

7.2. Restricted local optima. Lagrange theorem

7.3. Global constrained optima of concave and convex functions

7.4 Weierstrass Theorem

7.5. Introduction to inequality constraints

Methodology

To achieve the objectives of the course, the following taxonomy of activities will be used:

1. Theory classes where teachers develop the main concepts.

The objective of this activity is to present the fundamental notions of course, and to facilitate their learning through the analysis of examples illustrating the intuitions and economic applications.

2. Exercises sessions devoted to the resolution of problems.

This activity aims to discuss and answer any questions that students may have in solving the problem sets, and at the same time to correct mistakes. These sessions will also stimulate the participation of students presenting the solutions of the problem sets either orally or in written form.

3. Organized supervised activities, to apply the concepts studied to economic situations

The objective of this activity is to encourage the student to establish links between the mathematical tools and their use in economics. When possible, these sessions will be organized in small groups of students.

4. Problem solving by students

Each topic will have a list of associated problems that must be solved independently by students.
The objective of this activity is two-fold: on the one hand it aims at the reinforcement of the theoretical concepts and tools exposed in the theory sessions; on the other hand it aims at the acquisition of the skills required to solve exercises and problems.
We promote the cooperative resolution of problems in stable working groups of 3 or 4 students throughout the semester, to stimulate team work to overcome the difficulties that may arise to their components.

5. Tutorial attendance

Students have several hours where the teachers of the course may help them to resolve any doubts that may arise in the study of the course and in the solution of the problem sets. These sessions cannot be on-line, but face-to-face between the teacher and the students.

The proposed teaching methodology may undergo some modifications according to the restrictions imposed by the health authorities on on-campus courses.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	13	0.52	4, 8, 6, 7, 2
Theory classes	33	1.32	4, 8, 6, 7, 2
Type: Supervised			
Tutoring	10	0.4	
Type: Autonomous			
Preparation and solution of exercises	45.5	1.82	4, 8, 6, 7, 2

Study	45	1.8	4, 8, 6, 7, 2

Assessment

The course's evaluation will be carried out in a continuous way, through mid-term and final evaluations. The typology of activities and their share on the final grade are the following:

- Final exam: 50% of the final grade

- Mid-term exam: 30% of the final grade

- Deliverable activities and continuous evaluation: 20% of the final grade

Final Exam:

The final exam is a comprehensive exam of all the topics of the course. The exam is designed to encourage students to make a last effort of learning to consolidate previously acquired knowledge. The maximum resolution time is 2 hours.

If using the weights mentioned above a student's grade is 5 or higher, the course will be considered as passed and it can not be the subject of a new assessment.

A student is considered "no graded" in the subject only if he or she has not participated in any of the evaluation activities. Therefore, the participation in any of the graded activities eliminates the no graded outcome.

Calendar of evaluation activities

The dates of the evaluation activities (exercises in the classroom, assignments, ...) will be announced well in advance during the semester.

The dates of the mid-term and final exams are scheduled in the assessment calendar of the Faculty.

"The dates of evaluation activities cannot be modified, unless there is an exceptional and duly justified reason why an evaluation activity cannot be carried out. In this case, the degree coordinator will contact both the teaching staff and the affected student, and a new date will be scheduled within the same academic period to make up for the missed evaluation activity."***Section 1 of Article 115. Calendar of evaluation activities (Academic Regulations UAB)***. Students of the Faculty of Economics and Business, who in accordance with the previous paragraph need to change an evaluation activity date must process the request by filling out an Application for exams' reschedule
https://eformularis.uab.cat/group/deganat_feie/application-for-exams-reschedule

Grade revision process

After all grading activities have ended, students will be informed of the date and way in which the course grades will be published. Students will be also be informed of the procedure, place, date and time of grade revision following University regulations.

Retake Process

"To be eligible to participate in the retake process, it is required for students to have been previously been evaluated for at least two thirds of the total evaluation activities of the subject."Section 3 of Article 112 ter. The recovery (UAB Academic Regulations). Additionally, it is required that the student to have achieved an average grade of the subject between 3.5 and 4.9.

The date of the retake exam will be posted in the calendar of evaluation activities of the Faculty. Students who take this exam and pass, will get a grade of 5 for the subject. If the student does not pass the retake, the grade will remain unchanged, and hence, student will fail the course.

Irregularities in evaluation activities

In spite of other disciplinary measures deemed appropriate, and in accordance with current academic regulations, *"in the case that the student makes any irregularity that could lead to a significant variation in the grade of an evaluation activity, it will be graded with a 0, regardless of the disciplinary process that can be instructed. In case of various irregularities occur in the evaluation of the same subject, the final grade of this subject will be 0"*. ***Section 10 of Article 116. Results of the evaluation. (UAB Academic Regulations).***

The proposed evaluation activities may undergo some changes according to the restrictions imposed by the health authorities on on-campus courses.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Deliverable activities and continuous evaluation	20%	0	0	1, 4, 8, 5, 6, 7, 10, 2, 11, 12
Final exam	50%	2	0.08	1, 4, 3, 8, 9, 6, 7, 10, 2, 11, 13
Partial Exam	30%	1.5	0.06	4, 3, 8, 9, 6, 7, 2

Bibliography

Recommended textbook:

Sydsaeter, K. and P.J. Hammond, 2012, Essential Mathematics for Economic Analysis. Fourth edition. Pearson Education.

This textbook has contents and level appropriate for the course. Problems from this book will be presented in class. You must have access to this book.

Complementary textbook:

Sydsaeter, K. and P.J. Hammond, 1995, Mathematics for Economic Analysis. London, Prentice Hall.

This is a slightly more advanced textbook, of great tradition and acceptance. It is recommended to students who feel well prepared and who wish to study at a deeper level.

Other textbooks:

The textbooks listed below can be helpful to complement the explanations contained in the main textbook and also to students wishing to enlarge their knowledge.

Alegre, P., L. Jorba, F.J. Orti, G. Rodriguez, J.B. Saez, T. Sancho and A. Terceño, 2000, Ejercicios Resueltos de Matemáticas Empresariales II, Madrid, Alfacentauro.

Besada, M., F.J. García, M.A. Mirás and M.C. Vázquez, 2001, Cálculo de varias variables. Cuestiones y ejercicios resueltos, Madrid, Ed. Prentice Hall.

Chiang, A.C., 2005, Fundamental Methods of Mathematical Economics, McGraw-Hill. Larson, R., R. Hostetler, and B. Edwards, 1994, Calculus with Analytic Geometry, Lexington, D.C. Heath.

Other complementary material will be uploaded in the webpage of the course.