UAB
Universitat Autònoma de Barcelona

Mathematics II

Code: 102344
ECTS Credits: 6

2024/2025

Degree	Type	Year
2501572 Business Administration and Management	FB	1
2501573 Economics	FB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

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

Business Administration and Management

- Apply mathematical instruments to synthesise complex economic-business situations.
- Capacity for oral and written communication in Catalan, Spanish and English, which enables synthesis and oral and written presentation of the work carried out.
- Demonstrate an understanding of mathematical language and some methods of demonstration.
- Organise the work in terms of good time management, organisation and planning.
- Use of the available information technology and adaptation to new technological environments.

Economics

- Apply mathematical instruments to synthesise complex economic-business situations.
- Capacity for independent learning in the future, gaining more profound knowledge of previous areas or learning new topics.
- Demonstrate an understanding of mathematical language and some methods of demonstration.
- Demonstrate initiative and work individually when the situation requires it.
- Organise the work in terms of good time management, organisation and planning.
- Select and generate the information necessary for each problem, analyse it and take decisions based on that information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills in order to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Use of the available information technology and adaptation to new technological environments.

Learning Outcomes

1. A capacity of oral and written communication in Catalan, Spanish and English, which allows them to summarise and present the work conducted both orally and in writing.
2. Analytically consider and solve optimisation problems in the context of the economy.
3. Apply the inverse function and implicit function theorems to specific problems.
4. Calculate and study the extrema of functions.
5. Calculate derivatives of functions using the chain rule, the implicit function theorem, etc.
6. Calculate determinants and decompositions of matrices.
7. Capacity to continue future learning independently, acquiring further knowledge and exploring new areas of knowledge.
8. Classify matrices and linear applications according to different criteria (rank, diagonal and Jordan).
9. Demonstrate initiative and work independently when required.
10. Know the basic results of differential calculus on different real variables.
11. Organise work, in terms of good time management and organisation and planning.
12. Solve and discuss linear equation systems.
13. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
14. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
15. Students must develop the necessary learning skills in order to undertake further training with a high degree of autonomy.
16. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
17. Use available information technology and be able to adapt to new technological settings.
18. Work with different finite-dimensional bases of vector spaces.

Content

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 restrictions

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 restrictions

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Preparing and solving exercises	17	0.68	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18
Theory classes	32.5	1.3	2, 3, 4, 5, 6, 8, 10, 12, 18
Type: Supervised			
Follow-up of homework	3	0.12	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18
Tutorships	7	0.28	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18
Type: Autonomous			
Preparation and solution of exercises	40	1.6	
Study	45	1.8	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 17, 18

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 anydoubts 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.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Deliverable activities and continuous evaluation	20%	2	0.08	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18
Final exam	50%	2	0.08	2, 3, 4, 5, 6, 8, 10, 12, 18
Mid-term exam	30%	1.5	0.06	2, 3, 4, 5, 6, 8, 10, 12, 18

This subject/module does not offer the option for comprehensive evaluation.

Evaluation criteria

The grade of the midterm exam will wieght a 30% of the average grade of the subject.

The grade of the final exam will weight a 50% of the average grade of the subject.

The grade of the submission of exercises, essays and/or quizzes in the lab will weight a 20% of the average grade of the subject.

Therefore, the average grade of the subject is computed as:

average grade of the subject = 30% (grade of the midterm exam) +
+ 50% (grade of the final exam) +
+ 20% (grade exercises/essays/lab quizzes)

The subject will be considered "passed" if the following two requirements are met:

1. the average grade of the subject is equal to or greater than 5 and
2. the grade of the final exam is equal to or greater than 3.

- A student that meets the first requirement above but does not meet the second will recevie an average grade of the subject equal to 4.5, and will qualify for the re-evaluation test according to what is established in the section "Retake Process" below.
- A student that meets the second requirement above but does not meet the first, or any of them, will qualify for the re-evaluation test according to what is established in the section "Retake Process" below.

A student who has not participated in any of the assessment activities will be considered "Not evaluable"

Calendar of evaluation activities

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

The date of the final exam is 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 264. 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: e-Formulari per a la reprogramació de proves.

Grade revision process

After all grading activities have ended, students will be informed of the date and way in which the course grades willbe 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 2 of Article 261. The recovery (UAB Academic Regulations). Additionally, it is required that the student to have achieved an average grade of the subject greater than or equal to 3.5 and less than 5.

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 11 of Article 266. Results of the evaluation. (UAB Academic Regulations).

Bibliography

The main textbook

Sydsaeter, K. and P.J. Hammond, 2012, Essential Mathematics for Economic Analysis. Fourth edition. Pearson Education. (available online UAB library)

The fourth edition will be used extensively in class. There is a fifth edition available, which is also suitable.

Complementary Bibliography

The same authors have a somewhat more advanced text: Sydsæter, Knut, et al. Further mathematics for economic analysis. Pearson education, 2008, which students

who have a special interest in mathematics may prefer.

Software

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Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	4	English	second semester	morning-mixed
(PAUL) Classroom practices	8	English	second semester	morning-mixed
(PAUL) Classroom practices	51	Catalan	second semester	afternoon
(PAUL) Classroom practices	52	Catalan	second semester	afternoon
(PAUL) Classroom practices	60	Spanish	second semester	morning-mixed
(TE) Theory	1	Spanish	second semester	morning-mixed
(TE) Theory	2	Catalan	second semester	morning-mixed
(TE) Theory	4	English	second semester	morning-mixed
(TE) Theory	8	English	second semester	morning-mixed
(TE) Theory	51	Catalan	second semester	afternoon
(TE) Theory	52	Catalan	second semester	afternoon
(TE) Theory	60	Spanish	second semester	morning-mixed