Universidad Zaragoza

Academic Year/course: 2024/25

30602 - Mathematics I

Syllabus Information

Academic year: 2024/25
Subject: 30602 - Mathematics I
Faculty / School: 109 - Facultad de Economía y Empresa
Degree: 432 - Joint Law - Business Administration and Management Programme
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Basic Education
Module:

1. General information

Mathematics subjects are, for future graduates in Business Administration and Management, a working methodological instrument that must serve as a support for other subjects, such as Microeconomics, Macroeconomics, Econometrics, etc.

The general goal of these subjects is to study economic problems from a formal point of view, i.e. to model economic reality in order to understand it and give a scientific explanation of what has happened, as well as to try to predict what is going to happen.

Specifically, Mathematics I aims to broaden mathematical knowledge of calculus matricial calculus and functions of one variable and to introduce the study of functions of several variables, thus preparing students to assimilate in Mathematics II, taught in the second four-month period of this year, the mathematical tools most used in economic analysis, fundamentally in the field of Economic Theory and Econometrics. This first subject of Mathematics helps students to take off from their fundamentally calculistic knowledge, typical of Mathematics in secondary education, towards the rigor and abstraction of the scientific field of Mathematics, whichwill allow them to face other subjects of the degree that use mathematical apparatus and future challenges within their profession.

At the end of the subject, students will know with certain precision the mathematical language, which will allow them to understand economic concepts and interpret results with certain rigor, and will know a set of instruments and calculation methods that will allow them to solve simple economic problems

These approaches and goals are aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda of the United Nations () Agenda (https://www.un.org/sustainabledevelopment/es/), in particular, the activities planned in the subject will contribute to the achievement of goals 1-17, as mathematical modeling can be applied in all of them

It is advisable that at the beginning of this subject the students have skills in the handling of arithmetic operations, of matrices and of real functions of a real variable, at the level of the knowledge acquired in the Baccalaureate subject Mathematics Applied to Social Sciences II.

2. Learning results

At the end of the course the students will be able to:

1: Use mathematical language, both in its comprehension and writing.

2: Distinguish when the relationships between the variables of a problem are linear or nonlinear and use for their representationthe appropriate mathematical instrument in each case.

3: Use matrix notation and calculus to represent and solve an economic problem in which the relationships between variables are linear.

4: Solve a system of compatible linear equations using the most appropriate method and interpret its solutions in the context from which it comes if it is the case.

5: Determine if a square matrix is diagonalizable and diagonalize it if necessary.

6: Apply the diagonalization of square matrices in the economic context, for example in the study of a long-run dynamic process.

7: Identify a quadratic form and determine its sign with the most appropriate procedure.

8: Differentiate between endogenous and exogenous variables in an economic phenomenon and to represent the relationships between them by means of functions.

9: Understand the meaning of the mathematical concepts of continuity and differentiability in the economic context.

10: Be proficient in the calculation of partial derivatives and their interpretation in the economic field.

11: Recognize the chain dependence of different variables and calculate the variation of the final variables with respect to any of the initial ones.

12: Recognize whether a function is given in explicit or implicit form and obtain the partial derivatives in either case.

13: Recognize when a function is homogeneous and the implications of this property, particularly in the context of production functions.

14: Recognize the mathematical tool that allows to determine a total magnitude from the corresponding partial 15: Understand

the concepts of primitive of a function and indefinite integral.

16: Recognize if the indefinite integral of a function is immediate and solve it with the application of the table of immediate integrals . Identify the most appropriate method to calculate the indefinite integral of a function.

17: To understand the geometric meaning of the definite integral: Riemann integral.

18: Apply Barrow's rule for the calculation of the definite integral.

3. Syllabus

Unit 1. **Matrices**

1.1. Determinants. Applications: calculating the rank of a matrix, calculating the inverse matrix and Cramer's Rule.

1.2. Rn: Generator systems. Basis.

1.3. Diagonalization of square matrices:

1.3.1. Eigenvalues and eigenvectors of a square matrix: definition and calculation.

1.3.2. Diagonalization of a square matrix.

1.3.3. Application to the calculation of matrix powers.

Topic 2. Real quadratic forms

2.1- Quadratic forms: definition. Matrix expression and polynomial expression.

2.2- Diagonal expression of a quadratic form.

2.3- Classification of a quadratic form according to its sign.

2.4- Restricted quadratic forms.

Unit 3. **Functions of Rn in Rm**

3.1- Preliminaries: topological concepts.

3.2- Functions: domain, range and graph. Level sets of scalar functions.

3.3- Continuity of a function.

3.4- Derivation of a function. Partial derivatives. Gradient vector. Jacobian matrix.

3.5- Differentiable function. Directional derivative of differentiable functions.

3.6- Derivation of composite functions: Chain rule. Tree diagrams.

3.7. Higher order derivatives. Schwartz theorem. Hessian matrix. Taylor's Theorem.

3.8. Implicit function theorem. Derivation of implicit functions.

3.9. Homogeneous functions. Euler's Theorem.

3.10. Basic methods of integration of a function of one variable. Barrow's rule.

4. Academic activities

Facilitate student achievement of the intended learning results, it is proposed:

Master classes: 30 hours, in which the presentation of concepts and results will be combined with the participatory resolution of exercises, in which the theoretical aspects explained will be applied immediately. These classes will be face-to-face and will be given to the whole group at.

Practical classes: 30 hours, in which the students will solve, with the help of the professor, more complete exercises and problems of an economic nature. These exercises can be found at the following url. These classes will be face-to-face and will be given to half of the group at .

Other activities (Tutorials, Personal Study, Works, Seminars, Assessment Tests, ...): 90 hours.

6 ECTS = 150 hours

In principle, the teaching methodology and its assessment is planned to be based on face-to-face classes . However, if circumstances so require, they may be carried out online.

5. Assessment system

The evaluation will be GLOBAL in both the first and second sittings. It will consist of a final exam to be taken on the dates determined by the Faculty. The global exam will be written and will assess the proposed learning outcomes through questions that are theoretical, practical, or of a mixed theoretic-practical character and that will be based on the topics taught. It will be worth 10 points.

In addition, in the first sitting, it will be possible for students to take a voluntary intermediate test worth 5 points. This test will assess the student's knowledge of the Chapters 1 and 2 of the subject, and it will take place during the class schedule. The students who obtain a mark of at least 50% of the maximum value in this test (2.5 points out of 5) will be able to eliminate the corresponding topics from the global exam at the first sitting, and to take the exam of only the rest of the contents (worth 5 points out of 10). In this case, the mark corresponding to the eliminated topics will be added to the mark of the global exam. In order to pass the subject the student should obtain a minimum of 5 points out of 10. If the student obtains a mark of at least 2.5 points out of 5 in the intermediate test and wants to do the whole global exam anyway, the best of the two marks in the first part of the subject will be considered to compute the final mark.

To be eligible for this form of assessment students are required to participate actively and resolve issues, exercises and tests

that will be presented in the classroom, according to indications that the teacher in charge of each group of the subject will be exhibiting the same day of the presentation. In such a case, it is necessary to attend and participate in at least 75% of the face-to-face sessions or proposed activities. The student that at the end of the semester does not fulfill this requirement will not be able to be eligible to this procedure of assessment.

It has to be taken into account that the evaluation process closes at the end of the academic year, so it is not possible to claim academic merits from one academic year in a later one.

Evaluation criteria

Students will be assessed on whether they have acquired the learning outcomes mentioned above. In particular, they will be assessed on the following aspects:

1. Correct mathematical writing.
2. Logical reasoning in the posing and solving of the problems.
3. Reference to the theoretical results used, when relevant.
4. The choice of the most appropriate method for the solving of problems.
5. Clarity in the application of mathematical concepts and procedures.
6. The correct expression of the results obtained when solving problems.
7. The interpretation of the results, if applicable, in the context of the given problem.

6. Sustainable Development Goals

4 - Quality Education
8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure