Universidad Zaragoza

Academic Year/course: 2023/24

30602 - Mathematics I

Syllabus Information

Academic year: 2023/24
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**, both in the **first and second call**, and will consist of a final exam to be held at

the period established by the Center. This exam will be written and will evaluate the proposed learning results by means of theoretical, practical and/or theoretical-practical questions that will be adjusted to the subject matter. Scoring out of 10 points.

In addition, in the **FIRST CALL** there is the possibility of taking a voluntary intermediate test valued at 5 points. This test will assesss the knowledge of the subject corresponding to topics 1 and 2 of the program of the subject and will take place during class time. If a grade higher or equal to 50% of the grade (2.5 points out of 5) is obtained in said test , the student may choose to eliminate said subject from the global exam of the first call and only examine the remaining contents (valued at 5 points); in this case, the grade corresponding to the eliminated subject will be transferred to the grade of the global exam. A minimum of 5 out of 10 points must be obtained to pass the subject. If the student obtains a grade higher or equal to 50% of the grade (2.5 points out of 5) and wants to take the whole of the global test, the better of the two grades in the first part will be considered to calculate the total grade.

In order to be eligible for this form of assessment it is mandatory to actively participate and solve the questions, exercises and tests that will be carried out in the face-to-face classes, according to the indications that the teacher responsible for each group

of the subject will expose the day of the presentation of the same. In this case it is necessary to attend and participate in at least 75% of the face-to-face sessions and/or proposed activities. The student who at the end of the semester does not comply with this requirementwill not be eligible for this assessment procedure.

It should be noted that academic years close the evaluation processes, which means that no merits from one year can be claimed for subsequent academic years

Assessment criteria

It will be assessed whether the student has acquired the learning results outlined above. In particular, the following aspects will be assessed::

1. The correct use of writing mathematical language.
2. Logical reasoning in the approach and resolution of problems.
3. The reference to the theoretical content used is noteworthy.
4. The choice of the appropriate method for solving the problem
5. Clarity in the application of mathematical concepts and procedures.
6. The correct expression in the results obtained when solving problems.
7. Interpretation of the results, if applicable, in the context of the problem posed.