Universidad Zaragoza

Academic Year/course: 2022/23

27402 - Mathematics I

Syllabus Information

Academic Year: 2022/23
Subject: 27402 - Mathematics I
Faculty / School: 109 - Facultad de Economía y Empresa
Degree: 417 - Degree in Economics
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Basic Education
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The objective of this subject is that the students should develop the analytical skills, rigour and intuition needed for using mathematical concepts and results and that they should be able to apply these abilities to the analysis of problems of an economic nature. Therefore, the teaching should aim to provide students with a solid mathematical knowledge and to train them in a way of reasoning that will allow them thereafter to successfully solve a wide variety of questions in an economic scenario.

4.2. Learning tasks

The program offered to the students to help them achieve the learning results includes the following activities:

1. **Type 1 activities (Lectures)**: 30 hours (1.2 ECTS credits), which will be based on lectures to present the concepts and results corresponding to the contents of the subject. At the same time, some exercises will be solved with the participation of the students to help them comprehend the theoretical concepts presented. These classes are face-to-face and will be given to the full group.

2. **Type 2 activities** (**Practice sessions in classroom**): 30 hours (1.2 ECTS credits). the students will apply the theoretical results in order to solve, with the teacher?s help, more complete exercises, and problems of an economic nature. Problem sheets will be available for the students and the teacher will announce in advance the problems that will be solved in each practical lesson so that the students can prepare them beforehand. These classes are face-to-face and will be given separately to each subgroup.

3. **Type 6 activities** (**Teaching assignments**): up to 24 hours (0.96 ECTS credits), which may consist of a number of different activities designed to support the learning process, including: follow-up of some simple projects that had been assigned to small teams of students and the presentation of these projects; answering questions that students may have regarding some of the contents taught; solving problems of an economic nature by using some of the mathematical tools

taught during the classes, etc. These seminars may also be devoted to the teaching of more advanced topics, intended for the students interested in learning some further mathematical tools that would allow them to deal with more general problems.

4. **Type 7 activities** (**Autonomous work and study**) (from 60 hours).

5. **Type 8 activities** (**Assessment**). Final exam and midterm exams: (6 hours)

Total: 150 hours (6 credits ECTS)

If the availability of teaching staff is less than the teaching assignment and type 6 activities cannot be carried out, these activities will be replaced by type 7 activities.

The teaching methodology is expected to be face-to-face. However, if for public health reasons it were necessary, the classes might take place online.

4.3. Syllabus

The contents detailed in the program below will be developed in the theoretical and practical classes. Any variations in the order in which the topics will be taught will be indicated by the teacher in the presentation of the subject.

TABLE OF CONTENTS

Chapter 1. Matrices

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

1.2. R^n : Spanning sets. 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.

Chapter 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. Constrained quadratic forms.

Chapter 3. Functions from R^n to R^m

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. Differentiation of a function. Partial derivatives. Gradient vector. Jacobian matrix.

3.5. Differentiability. Directional derivative of differentiable functions.

3.6. Differentiation of composed functions: Chain?s Rule. Tree diagrams.

3.7. Higher order derivatives. Schwarz?s Theorem. Hessian matrix. Taylor?s Theorem.

3.8. Implicit function Theorem. Differentiation of implicit functions.

3.9. Homogeneous functions. Euler?s Theorem.

3.10. Basic integration methods of function of one variable. Barrow?s Rule.

4.4. Course planning and calendar

The calendar will be explained to the students in the presentation of the subject.

4.5. Bibliography and recommended resources