Universidad Zaragoza

Academic Year/course: 2022/23

27408 - Mathematics II

Syllabus Information

Academic Year: 2022/23
Subject: 27408 - Mathematics II
Faculty / School: 109 - Facultad de Economía y Empresa
Degree: 417 - Degree in Economics
ECTS: 6.0
Year: 1
Semester: Second 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

Chapter 1: Mathematical programs

1.1. General formulation of a mathematical program. Classification.

1.2. Definitions and properties. Weierstrass' Theorem.

1.3. Graphical solving.

1.4. Introduction to convexity:

1.4.1. Convex sets. Definition and properties.

1.4.2. Convex and concave functions. Definitions and properties.

1.4.3. Convex programs.

Chapter 2: Programming without constraints

2.1. Problem's formulation.

2.2. Local optima:

2.2.1. First order conditions for the existence of a local optimum.

2.2.2. Second order conditions for the existence of a local optimum.

2.3. Global optima: convex programs.

Chapter 3: Programming with equality constraints

3.1. Problem's formulation.

3.2. Local optima:

3.2.1. First order conditions for the existence of a local optimum.

3.2.2. Second order conditions for the existence of a local optimum.

3.3. Global optima: convex programs and Weierstrass' Theorem.

3.4. Economic interpretation of the Lagrange's multipliers.

Chapter 4: Linear programming

4.1. Formulation of a problem of linear programming.

4.2. Solutions of a linear program. Basic feasible solutions.

4.3. Characterization of the optimal basic feasible solutions. Simplex' Algorithm.

4.4. Introduction to the sensitivity analysis.

4.5. Introduction to the dual program.

Chapter 5: Introduction to ordinary differential equations

5.1. Introduction to the dynamical analysis.

5.2. Concept of differential equation, solution and types of solution.

5.3. First order ordinary differential equations:

5.3.1. Separable equations.

5.3.2. Linear first order equations.

5.4. Linear differential equations of order n with constant coefficients.

5.5. Qualitative analysis: equilibrium points and stability.

4.4. Course planning and calendar

In the first session of the semester it will be presented in each group the detailed schedule of the subject according to the characteristics of the academic year.