

## 27339 - Operative Research

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 27339 - Operative Research

**Faculty / School:** 109 - Facultad de Economía y Empresa

**Degree:** 448 - Degree in Business Administration and Management

**ECTS:** 5.0

**Year:** 4

**Semester:** First semester

**Subject Type:** Optional

**Module:**

## 1. General information

### 1.1. Aims of the course

The course is oriented to decision support and contributes, according to the evolutionary paradigms, in three key aspects of the student's training (3Ps): (i) it helps to make a decision (product); (ii) it enhances understanding of the decisional process (process) and, most important, (iii) it supports the integral formation of individuals (people) and the improvement of the systems in which they are immersed, providing them with a set of skills and attitudes to address the scientific resolution of any problem, even problems that do not arise in the economic context.

Taught in the last year of the degree, it has an instrumental and professional contribution. It presents the methods, models and techniques most commonly used in the scientific solving of business problems and introduces the computer systems used as decision support. In short, it seeks to provide scientific rigour in all stages of the decision-making process using decisional tools.

These approaches and aims are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 agenda, so that the acquisition of the learning outcomes of the subject provides training and competence to contribute to some extent to their achievement; specifically for SDG 1: No poverty (ignorance), SDG 4: quality education; SDG 8: decent work and economic growth; SDG 9: industry, innovation and infrastructure; SDG 11: sustainable cities and communities; SDG 12: responsible consumption and production; SDG 17: partnership for the goals.

### 1.2. Context and importance of this course in the degree

Because of its location (4th year) and content, the orientation given to the subject is eminently practical. As it combines the formative with the informative and the rational with the emotional, it will be taught in the computer room, where students will work in teams. Learning by rote and mechanical calculation effort will be avoided, enhancing teamwork, creativity, the use of the computer and the application of the techniques developed in class to real situations.

Operations Research acts as a link between theoretical modelling and practical implementation (mental ? structural ? formal ? resolution models). It also presents a series of optimization (uni- and multi-criteria) and simulation tools that are essential in solving problems in the different functional areas of the company and very appropriate for the development of degree dissertation, an aspect that will be addressed within the course.

### 1.3. Recommendations to take this course

This course, focused on solving complex scientific problems in the economic and business environment, has an eminently participatory and practical orientation, without any mnemonic requirement. The course aims to apply different decisional tools (analytical and computer) to the scientific resolution of a case study, as real as possible, selected by the student. This case may be closely related to the grade dissertation. No specific previous knowledge is required, apart from that acquired in the degree.

## 2. Learning goals

### 2.1. Competences

**Specific Competences:**

**E1.-** Assessing the situation and the foreseeable development of companies and organizations, making decisions and

drawing on the relevant knowledge with reference to social responsibility.

**E2.-** Understanding and applying professional standards and scientific rigour to the resolution of the economic, business and organizational problems.

**E3.-** Developing and drafting projects.

**Cross competences:**

**T1.-** Ability to solve problems.

**T2.-** Organizational and planning skills.

**T3.-** Ability to seek and analyse information from different sources.

**T4.-** Ability to make decisions.

**T5.-** Motivation for quality and excellence.

**T6.-** Adaptability to new situations.

**T7.-** Ability to apply knowledge in practice.

**T8.-** Ability to use technological tools necessary in the students' professional development.

## 2.2. Learning goals

Passing this course will enable the student to?

- Know the different scientific approaches followed throughout history to address the scientific resolution of economic and business problems.
- Know the new challenges and needs posed by scientific decision making in the so-called Knowledge Society.
- Handle common decisional tools with a cognitive orientation, in line with the holistic view of the real world.
- Keep abreast of the new scientific (multi-criteria) approaches followed in solving complex problems characterized by the existence of multiple scenarios, actors and criteria (both tangible and intangible).
- Be able to integrate into the decision-making process the objective, the rational and the tangible associated with traditional science together with the subjective, the emotional and the intangible associated with the human factor.
- In short, to be able to provide scientific rigour in resolving any decisional problem.

## 2.3. Importance of learning goals

The cognitive orientation given to the exploitation of the mathematical models used in the subject contributes, as mentioned above, to the 3Ps (Product, Process and People), that is, it helps the student to: (i) make timely decisions; (ii) better understand the decisional processes; and (iii) train people in one of the main aspects in the Knowledge Society: the decision-making. This training is not limited to skills (methods, models and techniques) but focuses on attitudes (skills, habits and qualities) when addressing decision-making in complex situations. Training in these kinds of intangible and emotional aspects is essential from the professional and human point of view, the latter being essential in the Knowledge Society.

# 3. Assessment (1st and 2nd call)

## 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student will demonstrate the achievement of the desired learning outcomes through the following assessment activities.

- **Globalassessment** in both official announcements, consisting of two parts:
  1. **Part I (uni-criterion):** individual computer tests using the decisional tools seen in the classroom, corresponding to the single criteria optimization, in a case proposed by the teacher (50% of the final grade). The computer tests will consist of two sections. The first (20% of the final grade), corresponding to units 1 and 2) will address the interpretation of the outputs of the software used in class. The second (30%), corresponding to units 3 y 4, will focus on modelling and solving problems of transport and logistics.
  2. **Part 2 (multicriteria):** presentation and defense of a project developed in small groups in which the decisional tools taught in the classroom corresponding to the multi-criteria optimization, heuristic methods and simulation will be applied to a problem as real as possible, selected by the student/s (50% of the grade). The Final projects selected by the students can address some parts of the Degree Thesis that students must submit. To take advantage of the synergies of teamwork, it will be favoured that the individual projects will be part of a group project that students can present collectively. The evaluation criteria will take into account the following issues: (i) Relevance of the selected theme (up 15 points); (ii) Modelling (up 15 points); (iii) Resolution (up 15 points); (iv) Use of the computer tools (up 15 points); (v) Exploitation and Learning (up 20 points) and (vi) formal aspects and presentation (up to 20 points).

### 2: Evaluation criteria

To pass the course the student must obtain at least a score of 5 out of 10, adding the two parts.

These tests are expected to be carried out in person but if the health circumstances require it, they will be carried out semi-on-site or online. In the case of online assessment, it is important to note that, in any test, the student may be

recorded, and he or she may exercise his or her rights by the procedure indicated in:

[https://protecciondatos.unizar.es/sites/protecciondatos.unizar.es/files/users/lopd/gdocencia\\_reducida.pdf](https://protecciondatos.unizar.es/sites/protecciondatos.unizar.es/files/users/lopd/gdocencia_reducida.pdf)

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as

As Operations Research has an eminently practical orientation, the presentation of the contents will take place in the computer room following an instrumental orientation. In parallel, the exploitation with cognitive purposes of the decisional tools studied in the classroom will be held in a narrative way, using unstructured methods (lateral thinking, group discussion...) for enhancing creativity and emotional skills. When possible, individual works will be grouped in a collaborative or multi-actor context, to train the students in the group decision-making process.

### 4.2. Learning tasks

This course is organized as follows:

- **Theory sessions** (15hours).
- **Exams** (5 hours)
- **Laboratory sessions (computer room)** (35 hours).
- **Assignments realization** (12,5 hours).
- **Tutorials, Autonomous work and study** (57,5 hours).

Apart from the regular theory sessions in the computer room (decisional tools), the students' training will be complemented by lectures and seminars that will be communicated in advance. Also, a collaborative tool for discussion and debate on the more relevant economic and business issues will be enabled.

In principle, the teaching delivery methodology is expected to pivot around face-to-face classes. However, if necessary, for health reasons, face-to-face classes may be taught semi-face-to-face or online.

The necessary software will be used to check the originality of the activities carried out. The detection of plagiarism or copying in an activity will imply the rating of 0 points in it.

### 4.3. Syllabus

This course will address the following topics:

- **Topic 0: Preface**
  - 0.1 Presentation
  - 0.2 Principal objectives and approach
  - 0.3 Programme
  - 0.4 Assessment
- **Topic 1: Foundations of Decision Making**
  - 1.1 Decision Making Problem
  - 1.2 Decision Making Process. Descriptive models.
  - 1.3 Basic concepts
  - 1.4 Structured and non-structured techniques.
- **Topic 2: Linear Programming**
  - 2.1 Linear models
  - 2.2 Simplex method
  - 2.3 Post-optimal analysis
  - 2.4 Software and applications
- **Topic 3: Transport and Distribution**
  - 3.1 Transport models. Algorithms.
  - 3.2 Transshipment model and Assignment model
  - 3.3 Post-optimal analysis
  - 3.4 Software and applications

- **Topic 4: Integer Programming**
  - 4.1 Introduction.
  - 4.2 Integer models. Algorithms.
  - 4.3 Case studies.
  - 4.4 Software and applications
  
- **Topic 5: Simulation.**
  - 5.1 Introduction
  - 5.2 Random numbers and random variables
  - 5.3 Simulation design and statistical analysis
  - 5.4 Simulation in Decision Making
  - 5.5 Software and applications
  
- **Topic 6: Multicriteria Decision Making. Multiobjective Programming.**
  - 6.1 Introduction
  - 6.2 Pareto optimal solutions
  - 6.3 Compromise programming
  - 6.4 Goal programming
  - 6.5 Software and applications
  
- **Topic 7: Multicriteria Decision Making. Multiattribute Programming.**
  - 7.1 Discrete Multicriteria Decision making
  - 7.2 Multiattribute Utility Theory (MAUT)
  - 7.3 Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP)
  - 7.4 Outranking methods: ELECTRE and Promethee methods
  - 7.5 Software and applications

#### 4.4. Course planning and calendar

During week 1 Introduction and Fundamentals of decision making (4 hours) will be introduced.

Weeks 2 and 3: Linear Programming (8 hours)

Weeks 4 and 5: Distribution and Transport (8 hours)

Week 6 and 7: Integer programming, Simulation and Computer Test (uniojective optimization) (8 hours)

Weeks 8 to 12: Multicriteria Decision Making (16 hours)

Weeks 13 to 15: Practical projects (multicriteria decision making) (6 hours)

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Moodle website (<https://moddle2.unizar.es>); Academic calendar website (<https://academico.unizar.es/calendario-academico/calendario>); or the website of your corresponding faculty (Zaragoza: <https://econz.unizar.es/>, Huesca: <http://fegp.unizar.es/>, Teruel: <http://fcsch.unizar.es/>).