

## 30125 - Extension of Operational Research

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 30125 - Extension of Operational Research

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 425 - Bachelor's Degree in Industrial Organisational Engineering

**ECTS:** 6.0

**Year:** 3

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The decisions made by an Industrial Organization Engineer concern a wide range of areas within a production process. The concept of optimization is basic to these types of decisions. In this context, operations research is an essential tool because it provides quantitative methods that support any type of technical decision within that production process. The subject has a strong applied character, where the resolution of practical cases and the use of basic computer tools are more important than the exhaustive development of mathematical contents related to the proposed topics.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement:

- GOAL 8. Decent Work and Economic Growth
- GOAL 12. Responsible Production and Consumption

### 2. Learning results

1. Differentiate between stochastic and deterministic models.
2. Identify and formulate more complex models involving nonlinear functions and/or integer variables.
3. Identify and formulate operational research models in real systems whose behavior depends on chance, to predict their performance and assist in decision making, either at the design stage or in the comparison of alternative policies.
4. Manage the mathematical foundations necessary for the resolution of these models.
5. Use computer programs to solve the proposed models.
6. Apply simulation models in the analysis of complex system.

### 3. Syllabus

1. Entire Programming: Binary, integer and mixed integer programming.
2. Non-linear programming: Karush-Kuhn-Tucker (CKKT) conditions. Numerical methods: SQP algorithm.
3. Dynamic programming: Discrete and continuous models.
4. Inventory theory: Fixed and stochastic demand.
5. Queuing theory: M/M/1 and M/M/C systems. Generalization to other systems.
6. Simulation with sand: Entities, resources, queues, basic and advanced processes

### 4. Academic activities

1. The subject is articulated with 4 hours of face-to-face class per week during the 15 weeks of the four-month period. All hours are taught in the computer classroom, where theoretical concepts are taught and reinforced with practical work through the use of mathematical software.
2. Personal work: 60 hours

### 5. Assessment system

#### Continuous assessment system

Written tests: There will be two written tests along the term. They will deal with theoretical and/or practical aspects of the subject. Its weight in the qualification is 60%. The learning outcomes to which they are related are 1, 2, 3, 4 and 6.

Participatory controls: Throughout the subject there will be 2 participatory type controls. Its weight in the rating is of 10%. The learning results to which they are related are 1, 2, 3, 4 and 6.

In the written tests and participatory type controls will be evaluated:

- understanding of the mathematical concepts used to solve problems
- the use of efficient strategies and procedures in their resolution
- clear and detailed explanations
- the absence of mathematical errors in development and solutions
- correct use of terminology and notation
- clear, orderly and organized exposition
- mastery and correct use of the mathematical software commands needed to solve problems the detail of the code used in the resolution of the problems

Work of an applied nature: An individual work on simulation and analysis of queueing theory will be carried out. Its weight in the qualification is 30%. The learning results to which they are related are 1, 2, 3, 4, 5 and 6.

In the works will be valued:

- mastery and correct use of the mathematical software commands needed to solve problems the correct resolution of the problems and the mathematical methods and strategies used
- the detail of the code used in the resolution of the problems
- the correct interpretation of the results obtained
- the ability to select the most appropriate method
- clear and detailed explanations and/or reasoning to the questions asked
- the final result and quality of the work
- the quality and coordination of the exposition
- the mathematical language used
- the quality of bibliographic sources
- teamwork
- the attitude shown during the development of the work, as well as the greater or lesser participation in it

### **Global assessment**

Students who have not passed the subject with the continuous assesment system must take a compulsory written test equivalent to the written tests described in point 1, whose weight in the final grade will be 70%, and must also submit the individual work that has been assigned to them throughout the subject, its weight being 30% of the final grade. The assessment criteria will be those set forth in the previous sections.