Universidad Zaragoza

Academic Year/course: 2023/24

28950 - Agri-food industry: design and optimisation

Syllabus Information

Academic year: 2023/24
Subject: 28950 - Agri-food industry: design and optimisation
Faculty / School: 201 - Escuela Politécnica Superior
Degree: 583 - Degree in Rural and Agri-Food Engineering
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Optional
Module:

1. General information

One of the specific objectives of the degree is to train the graduate for the direction and management of all kinds of agri-food industries. It is in the context of this professional profile that this subject is framed. The use of modeling and optimization techniques is essential when solving problems of productioncapacity sizing , waiting systems, location, plant layout, and production scheduling.

The approach and objectives of the course are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda:

- Goal 7: Ensure access to affordable, secure, sustainable and modern energy.
- Goal 9: build resilient infrastructures, promote sustainable industrialization and foster innovation.
- Goal 12: Ensure Sustainable Consumption and Production Patterns.

2. Learning results

At the end of the subject, students are expected to be able to:

1. Analyze the main variables affecting production capacity planning.
2. Evaluate alternatives for the location and subsequent plant layout of a production system.
3. Analyze a standby line system and improve its performance.
4. Model a transport network and estimate peak flow.
5. Model and optimize a given system by means of linear programming.
6. Simulate a basic agri-food process using a specific program (ASPEN HYSYS).
7. Improve the energy efficiency of a given process by simulating it in a HYSYS environment.

3. Syllabus

Block I: Design of production systems

Topic 1: productive capacity. Demand forecasting. Waiting systems (queuing theory and simulation).

Topic 2: plant location and distribution. Qualitative and quantitative analysis. Factors involved and case studies.

Block II: Modeling and optimization

Topic 3: Optimization of functions. Fundamentals. Numerical methods. Lagrange multipliers.

Topic 4: graph theory. Partial minimum cost tree. Transport networks: optimal flow.

Topic 5: linear programming. Simplex algorithm. Duality and sensitivity analysis. Practical classes.

Block III: Process simulation

Topic 6: Introduction to the ASPEN HYSYS program. Simulation of evaporation, rectification and absorption systems.

4. Academic activities

Theoretical classes (20 h): for the development of the contents of the proposed topics.

Practical sessions of case resolution (20 h): for the resolution of practical cases in a collaborative way.

Practical simulation sessions (20 h): for the resolution of simulation and optimization cases with the ASPEN program HYSYS.

Personal study and completion of practice reports (84 h).

Evaluation tests (6 h).

5. Assessment system

The subject will be assessed by a global assessment system through the following activities:

1. Individual written test, where several problems will be solved according to the guidelines and formats followed in the sessions of case resolution (60% of the final grade; minimum of 4 out of 10 points). The assessment criteria will be: approach, numerical solution, conceptual mastery and argumentative justification.

2. Collaborative practice reports, corresponding to four practical cases that will be presented throughout the term (40% of the final grade; minimum of 3.5 on average out of 10 points). In addition to the evaluation criteria described in the previous activity, the formal aspects of the reports will be taken into account. Each of the reports will be delivered through moodle on the dates set by the teaching team. Students not evaluated in this activity -which are presented in first or second call- will submit a single report which will include the resolution of all cases raised. This delivery will be made through moodle, with a deadline that will coincide with that of the official call. In justified cases, students may carry out the activity in the individual mode.

The detailed definition of the evaluation system will be presented in class during the presentation of the subject.

Success rates in previous years: 2019-20 (100%); 2020-21 (80%); 2021-22 (82%).