Universidad Zaragoza

Academic Year/course: 2022/23

28950 - Agri-food industry: design and optimisation

Syllabus Information

Academic Year: 2022/23
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

1.3. Recommendations to take this course

This subject is offered in the English Friendly form

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process is based on:

1) The **participatory lecture technique** (PLT) will be applied during the course of the theoretical sessions. Students will be encouraged to actively participate in the lectures by asking/answering questions and/or solve short exercises.

2) **Group work and collaborative learning** will be used during the course of the practical sessions, which will be focused on solving a number of problems and case studies.

3) Several **collaborative projects,** integrating concepts and techniques and based on the case studies analysed during the practical sessions, will be performed by the students (in groups of 2 or 3 members; the same groups as those established during the practical sessions).

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures in the classroom (22 h).
- Practical sessions in the computer classroom (36 h).
- Cooperative learning: during the practical sessions (in class) and the collaborative projects (out of class).
- Autonomous learning (out of class): students will be encouraged to resolve several exercises and questionnaires related to the subjects covered in the classroom. They will post the solution on the Moodle site and interact with each other.

- Individual or small-group tutoring, which can be face-to-face (in the desk of lecturers) or virtual (using the Moodle platform).

4.3. Syllabus

The course will address the following topics:

Theoretical program

- Thematic block I: Designing production systems.
  - **Topic 1**: PRODUCTION CAPACITY. Planning and programming production. Cost analysis. Predicting demand using time series models. Systems with delays (queuing theory). Feasibility study of investments affecting production capacity.
  - **Topic 2**: LOCATION AND LAYOUT OF THE PLANT. Qualitative and quantitative analysis to decide the location of one or several facilities. The layout of the plant: Types, factors to consider and SLP (*Systematic Layout Planning*).
- Thematic block II: Modelling and Optimisation.
  - **Topic 3**: OPTIMISING FUNCTIONS. Cases without restrictions and with one restriction. Lagrange multipliers.
  - **Topic 4**: GRAPH THEORY. Optimal route. Transport networks: Optimal flow.
  - **Topic 5**: LINEAR PROGRAMMING. Fundamentals. Simplex algorithm. Duality and sensitivity analysis.
- Thematic block III: Process Simulation.
  - **Topic 6**: Introduction to the Aspen HYSYS software. Compounds databases. Thermodynamic packages. Simulation environment. Optimization tools.

Practical program
Practical session resolving case studies

- **Case study 1**. Predicting demand using time series models.
- **Case study 2**. Analyzing systems with delays (Jackson's networks).
- **Case study 3**. Variation of the production capacity in the long term: Comparing different investment alternatives.
- **Case study 4**. Layout of a food processing facility.
- **Case study 5**. Transport network: maximun flow at minimal cost.
- **Case study 6**. Linear programming: Establishing the optimal production program and optimal purchasing plan.
- **Case study 7**. Simulation using Aspen HYSYS of an evaporation process.
- **Case study 8**. Simulation using Aspen HYSYS of a biodiesel purification plant.
- **Case study 9**. Simulation using Aspen HYSYS of a bioethanol purification plant.

4.4. Course planning and calendar

Schedule

Week	Theory	Case studies	Cases studies solved with HYSYS
1	4 h		
2		4 h	
3	2 h	2 h	
4	2 h	2 h	
5	2 h	2 h	
6		4 h	
7	2 h	2 h	
8	2 h	2 h	

9	2 h	2 h	
10	2 h		2 h
11			4 h
12	2 h		2 h
13			4 h
14			4 h
15			4 h

Workload

Learning activity	Hours in person	Factor	Homework
Theoretical lessons	20	1,5	35
Case studies	20	1,225	24,5
Simulation case studies	20	1,25	24,5
Evaluation	6		
TOTAL HOURS	66		84
TOTAL WORKLOAD	**150 h**		

4.5. Bibliography and recommended resources

BB   Hillier, Frederick S. Introducción a la investigación de operaciones / Frederick S. Hillier, Gerald J. Lieberman ; revisión técnica, Guillermo Martínez del Campo V., Ernesto A. Pacheco. 9a. ed. México [etc.] : McGraw-Hill, cop. 2010

BC   Taha, Hamdy A. Investigación de operaciones / Hamdy A. Taha; traducción Virgilio González Porro. 7ª ed. México [etc.] : Pearson Educación, 2004

The updated recommended bibliography can be consulted in :

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28950