Universidad Zaragoza

Academic Year/course: 2024/25

66210 - Advanced Separation Processes

Syllabus Information

Academic year: 2024/25
Subject: 66210 - Advanced Separation Processes
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 531 - Master's in Chemical Engineering
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Compulsory
Module:

1. General information

Using the knowledge of basic separation operations as a basis (distilling, absorption, extraction, etc.), the advanced separation operations are proposed (adsorption, membrane operations, drying, crystallization, etc.). Basic operations with particulate solids are also included (use of fixed and fluidized beds, solid conditioning, mechanical separations, etc.). There are also two transversal topics such as selecting separation operations and process intensification. This subject attempts to guide students when choosing the type of basic separation operation depending on the physical and chemical properties of the mixture to separate, on the operation scale and on the intended yield, among other important aspects. Environment care and economy are also taken into account.

2. Learning results

To pass this subject, students must demonstrate the following results:

- To select the most adequate operation for a separation process.
- To apply calculation methods based on mass and energy balances, as well as on specific concepts of property transfer.
- To design specific separation operations, select their configuration and calculate their size and yield.
- To solve complex problems using the knowledge acquired on mathematics, physics, chemistry and fundamentals on chemical engineering.
- To analyse and discuss the achieved results in order to be able to understand and explain how each of the operations specifically works.
- To apply the acquired knowledge to the understanding of systems that combine different unitary operations.

3. Syllabus

The foreseen syllabus for this subject is the following:

- Topic 1. Introduction (1 h).
- Topic 2. Operations with solids. General concepts and conditioning (5 h).
- Topic 3. Fix and fluidized beds (8 h).
- Topic 4. Mechanical solid separations. Filtering (5 h).
- Topic 5. Solid drying (6 h).
- Topic 6. Solid separation by adsorption (6 h).
- Topic 7. Membrane separations (7 h).
- Topic 8. Evaporation (5 h).
- Topic 9. Crystallization (6 h).
- Topic 10. Process intensification (4 h).
- Topic 11. Selection of separation processes (4 h).

4. Academic activities

- Master classes (30 h). In them, the theory of the different proposed topics will be explained and model problems will be solved.

Problem solving and case studies (15 h). In these classes, the teacher and the student, with the teacher´s supervision, will solve problems. The problems or cases will be related to the theoretical part explained in the master classes.

Practical work sessions (12 h). They will include advanced searches and complex problem solving. These sessions will deal with each topic. The teacher will lead the sessions and the student will end the corresponding exercise (individually or in groups of 2-3 people depending on the difficulty, work length, media availability etc.). In most of these sessions, students must submit a

deliverable to be corrected and assessed by the teacher and in some cases, an oral presentation will be requested.

Special practices (3 h) corresponding to a visit to a company, expert talk, thematic seminar. debate with an external expert, etc.

- Individual study (60 h). The student is advised to study continuously throughout the semester.

Both the mentioned practical sessions and the individual presentations will require of 24 additional hours to conclude a deliverable (a solved exercise, the presentation. etc.) for each of the thematic blocks.

-Assessment: (6 h). There will be a final exam where the student, with help from books and notes, must individually prove their theoretical and practical knowledge, as well as their ability to reason on specific and relevant topics of the subject.

5. Assessment system

The student must demonstrate achievement of the intended learning results through the following assessment activities:

Option 1:

Assessment is global and includes:

1. Solving practical cases and writing of academic assignments. These will turn into deliverables. Apart from the content and expected result, the expected reasoning and formal aspect, as well as the presentation will be valued (**E**).

2. Oral presentations (**P**).

3. Observation on the participation of subject activities (**O**).

4. Final exam at the end of the subject. In this exam, the student is allowed to use notes and books. It will include theoretical-practical reasoned questions where the knowledge application will be valued (**F**).

The grade of the subject will be calculated as follows:

$$\text{Grade} = 0{,}55 \cdot \boldsymbol{E} + 0{,}1 \cdot \boldsymbol{P} + 0{,}05 \cdot \mathbf{O} + 0{,}3 \cdot \mathbf{F}$$

The minimum requested grade in the exam, F, is 3.5 out of 10 in order to pass the subject. When a deliverable is not presente or an oral presentation is not made, the percentage of the final grade for that deliverable or presentation will be added to that of the final exam.

Option 2:

Those students who choose option 2 will sit for the official call exam (100% of the final grade). This option can be chosen for both calls of the subject.

6. Sustainable Development Goals

7 - Affordable and Clean Energy
9 - Industry, Innovation and Infrastructure
12 - Responsible Production and Consumption