Universidad Zaragoza

Academic Year/course: 2023/24

27216 - Fundamentals of Chemical Engineering

Syllabus Information

Academic year: 2023/24
Subject: 27216 - Fundamentals of Chemical Engineering
Faculty / School: 100 - Facultad de Ciencias
Degree: 452 - Degree in Chemistry
ECTS: 6.0
Year: 3
Semester: First semester
Subject type: Compulsory
Module:

1. General information

The objective of this subject is to acquire a practical vision of Chemical Engineering and its relationship with Chemistry and the current Chemical Industry . The subject aims to introduce students to the tools and basic knowledge of chemical engineering, to be able to face with a broad criterion the various problems that arise in the professional field.

It should lay the foundations for the calculations associated with chemical processes, fundamentally the resolution of matter and energy balances, transport phenomena, basic separation operations and the design of chemical reactors.

These approaches are aligned with **Sustainable Development Goals** 6, 9, 12 and 13 of the **2030 Agenda** (https://www.un.org/sustainabledevelopment/es/).

2. Learning results

1. Handle basic terminology and nomenclature in Chemical Engineering.
2. Propose, develop and solve macroscopic balances of matter and energy in steady-state processes of the Chemical Industry.
3. Know the mechanisms of matter and heat transport and the mathematical equations that describe them.
4. Know and know how to apply the equations of property transport between phases for the design of matter transfer equipment.
5. Apply calculation methods in the analysis and sizing of heat and material transfer equipment and chemical reactors.
6. Gather and interpret relevant data to make judgments that include a reflection on social, scientific or ethical issues.
7. Understand and convey information, ideas, problems and solutions to both specialized and non-specialized audiences. Be able to express oneself clearly orally and in writing, mastering the specialized language.
8. Teamwork, organization, planning and decision making.

3. Syllabus

Block 1. Master classes and problems

- Introduction to Chemical Engineering.
- Basic nomenclature and calculation methods. Unit systems. Dimensional analysis. Conversion of units.
- Macroscopic balances of matter and energy in steady state with and without chemical reaction.

Block 2: Master classes and problems

- Introduction to transport phenomena.
- Transport mechanisms. Transport equations within a fluid in molecular regime.
- Interphase transport. Individual and global transport coefficients. Heat exchanger design.
- Fundamentals of separation operations. Equipment for contact between phases. Design of columns of absorption.
- Introduction to reactor design. Batch and continuous reactors. Perfect mix and plug flow reactors .

Practical classes

- **Practice 1:** Absorption-Desorption G-L. Determination of individual matter transfer coefficients of O2 in water.
- **Practice 2.** CO2 absorption with chemical reaction.
- **Practice 3.** Solid-Liquid Extraction.
- **Practice 4.** Discontinuous distillation.
- **Practice 5:** Ideal Plug Flow and Perfect Mixing Reactor. Series Association of Ideal Reactors.

4. Academic activities

Block I. Introduction. Steady State Energy and Matter Balances

- Theoretical master classes with the entire group: 3 h
- Problem-solving master classes with the entire group: 6 h
- Classroom problem solving classes: 10 h
- Personal Study: 26 h
- Evaluation Tests 2 h

Block II. Transport Phenomena, Application to Equipment Design and Introduction to Separation Operations and Reactor Design

- Theoretical master classes with the entire group:14 h
- Problem-solving master classes with the entire group: 7 h
- Master classes to solve practical cases with the whole group: 3 h
- Classroom problem solving classes: 8 h
- Laboratory Practices: 9 h
- Personal Study: 58 h
- Evaluation Tests 4 h

5. Assessment system

Continuous evaluation

The subject is evaluated continuously through the following activities:

1. Written tests. There will be two tests, one at the end of Block I and the other at the end of Block II. It is necessary to pass both independently with a minimum grade of 5 points (out of 10). Passing a block exempts the student from taking the topics of that block in the written test of the global evaluation.
2. Laboratory practices. It is necessary to have completed the practices and obtain a minimum grade of 5 points (out of 10) in the laboratory practice questionnaires.
3. Individual problems and class participation, which may improve the final grade of each of the Blocks up to 1 point.

Overall evaluation

Students who do not opt for or do not pass the continuous evaluation will take the global test (first and second calls), which will consist of a written test of each of the two blocks of the program, which will have to be passed independently . There will also be a laboratory practice session for those students who have not passed or have not completed the corresponding laboratory practice during the academic year.

The final grade, both for continuous and global evaluation, will be calculated according to the following formula: **Final grade = (0.32 × Grade Block I) + (0.68 × Grade Block II)**

- Block I grade = test grade
- Grade for Block II = (0.8 × test grade) + (0.2 × practical questionnaire grade)