

29922 - Applied Chemical Kinetics

Syllabus Information

Academic year: 2024/25

Subject: 29922 - Applied Chemical Kinetics

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 330 - Complementos de formación Máster/Doctorado
435 - Bachelor's Degree in Chemical Engineering

ECTS: 6.0

Year: 435 - Bachelor's Degree in Chemical Engineering: 3

330 - Complementos de formación Máster/Doctorado: XX

Semester: First semester

Subject type: 435 - Compulsory

330 - ENG/Complementos de Formación

Module:

1. General information

The subject presented in the *Applied Chemical Kinetics* course aims that the student develops the necessary skills to understand and know how to apply the strategies that allow to deduce the kinetic equations of chemical reactions, both in homogeneous and heterogeneous systems, in the absence and in presence of catalysts. Kinetic information is basic for reactor design, optimization and control in chemical industry processes.

2. Learning results

1. Ability to apply the basic knowledge acquired to perform material and energy balances.
2. Interpret kinetic information for homogeneous and heterogeneous reactions and know how to apply it to the chemical industry.
3. Analyze the influence of the main variables on the observed reaction rate.
4. Know the transport phenomena coupled to heterogeneous kinetics.
5. Know and understand how to apply the different mathematical methods for the determination of the equation of rate of a chemical reaction.
6. Solve chemical kinetics problems and interpret results.

3. Syllabus

Block 1. Introduction.

- Unit 1. Basic concepts of Applied Chemical Kinetics.

Block 2. Kinetics of homogeneous reactions.

- Unit 2. Homogeneous reactions: Kinetic equation.
- Unit 3. Interpretation of kinetic data obtained in laboratory reactors. Batch reactors and continuous.
- Unit 4. Differential methods of kinetic data analysis.
- Unit 5. Integral methods of kinetic data analysis.
- Unit 6. Catalysis phenomenon. Homogeneous catalysis.

Block 3. Kinetics of heterogeneous reactions.

- Unit 7. Introduction to the kinetic study of heterogeneous reactions.
- Unit 8. Obtaining experimental kinetic data in catalytic gas/solid reactions.
- Unit 9. Kinetics and mechanism of reactions over solid catalysts.
- Unit 10. Deactivation of catalysts. Deactivation kinetics.

Block 4. Kinetics of enzymatic reactions.

- Unit 11. Enzymes. Homogeneous enzyme kinetics.

4. Academic activities

- **Master classes** (40 h). Presentation and explanation by the teacher of the theoretical contents and resolution of

model problems.

- **Problems and cases** (20 h). The student will solve in class, supervised by the teacher, problems and practical cases related to the theoretical classes.
- **Supervised work** (24 h). Resolution of problems and practical cases, proposed by the teacher, and that will be developed individually or in groups of 2 students. They will be distributed throughout the semester, being tutored and assessed by the teacher.
- **Personal study** (60 h). It is recommended that students distribute their personal work throughout the semester.
- **Assessment tests** (6 h). Development of midterm tests and final exam, or global test.

These activities will be complemented with individual or group tutorials throughout the course.

5. Assessment system

FIRST CALL. One of these options is available:

Option 1. Assessment composed of the valuation of the following activities:

1. Supervised works. (20% of the final grade). Resolution by the student, individually or in group, of questions, practical cases and problems.

2. First midterm test. (40% of the final grade). Written test (topics 1-6). It will consist of theoretical-practical questions and problem solving, being necessary a minimum score of 4.0 out of 10 in each part to average. A minimum grade of 4.5 will be required to average with the rest of activities.

3. Second midterm test. (40% of the final grade). Written test (topics 7-11) of similar characteristics as the first midterm test, for those students who have passed the 1st midterm test. It will be held simultaneously with the final exam (activity 4).

4. Final exam. (80% of the final grade). Global written test with all the contents of the subject, with similar characteristics to the midterm tests. The grade obtained must be equal to or higher than 4.5 to be averaged with the supervised works.

To pass the subject, a grade of 5.0 or higher must be obtained, considering activities 1-4.

Option 2. (100% of the final grade). Global written test of similar characteristics to the final exam of the option 1, adapted so that the student accredits the acquisition of all the learning results. A minimum score of 5.0 is required.

SECOND CALL FOR APPLICATIONS. (100% of the final grade). Global written test of similar characteristics to option 2 of the 1st round. It may represent 80% of the final grade for those students who have completed activity 1 (supervised works) of option 1, of the 1st call, and decide to keep the grade obtained.

6. Sustainable Development Goals

9 - Industry, Innovation and Infrastructure