Universidad Zaragoza

**Year : 2020/21**

# 29922 - Applied Chemical Kinetics

## Syllabus Information

**Academic Year:** 2020/21
**Subject:** 29922 - Applied Chemical Kinetics
**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura
**Degree:** 435 - Bachelor's Degree in Chemical Engineering
330 - Complementos de formación Máster/Doctorado
**ECTS:** 6.0
**Year:** XX
**Semester:** 330 - First semester
435 - First semester
**Subject Type:** 435 - Compulsory
330 - ENG/Complementos de Formación
**Module:** ---

# 1.General information

### 1.1.Aims of the course

### 1.2.Context and importance of this course in the degree

### 1.3.Recommendations to take this course

# 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

# 3.Assessment (1st and 2nd call)

### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

# 4.Methodology, learning tasks, syllabus and resources

### 4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favors the development of communication and decision-making skills. For the design of the learning process, it has been considered that this is a theoretical-practical subject. This implies a continued study of theoretical aspects and their subsequent application to the resolution of issues and problems of particular interest to allow the students to assimilate the contents of the subject.

Students are expected to participate actively in the class throughout the semester.

The teaching method includes explanatory slides containing the most important theoretical and practical aspects of the discipline. Numerous schemes and examples that allow easy assimilation and application of the most important concepts are provided. It also offers a collection of exercises and questions whose resolution will offer the student a tool for self-evaluation. This material is accompanied by a set of references for consultation and deepening.

### 4.2.Learning tasks

The subject "Applied chemical kinetics" requires a dedication by students of about 150 h, equivalent to 6 ECTS. The learning process is based on the following schedule of teaching and learning activities:

- Participative theoretical lectures (40 h). Lectures run for 3 weekly hours. The teacher explains the course contents

and solves representative applied problems. Regular attendance is highly recommended.

- Questions and exercises sessions (20 h). Students will solve problems and exercises related to concepts seen in lectures, supervised by the teacher. These problems and exercises can be found in the problem set provided at the beginning of the course.
- Programmed works (20 h). Students will work together in groups doing tasks such as assignments, practical calculations, and the use of graphical and analytical methods...
- Autonomous work (64 h). Students are expected to spend this time to study theory, solve problems, prepare sessions... Assessment tests (6 h).
- Individual tutorials throughout the course. Teacher's office hours allow students to solve questions and discuss unclear course contents. It is advisable to come with clear and specific questions.

The Reprography Service of EINA makes available to students the photocopies of slides, questions and exercises that include all the lessons of the course. In addition, all this is accessible on the platform ADDUnizar, via Moodle.

## 4.3.Syllabus

The course will address the following topics:

**Block 1. Introduction.**

Topic 1. Basics of Applied Chemical Kinetics.

**Block 2. Kinetics of homogeneous reactions.**

Topic

2. Homogeneous reactions: Kinetic equation. Elementary and non-elementary reactions. Reaction mechanisms. Dependence of the reaction rate on concentration and temperature. Activation energy. Arrhenius approach. The reaction rate from kinetic theories.Topic 3. Interpretation of kinetic data obtained in laboratory reactors: Batch and continuous reactors. Topic 4. Differential method of kinetic data analysis.Topic 5. Integral method of kinetic data analysis.Topic 6. Homogeneous catalysis.

**Block 3. Kinetics of heterogeneous reactions.**
Topic
7. Introduction to the kinetic study of heterogeneous reactions.

Topic 8. Heterogeneous catalytic reactions. Solid catalysts. General concepts of catalysis and adsorption. Obtaining experimental of kinetic data on gas / solid catalytic reactions.
Topic 9. Kinetics and mechanism of reactions on solid catalysts.Topic 10. Kinetics of deactivation of catalysts.

**Block 4. Kinetics of the enzymatic reactions.**

Topic

11. Enzymatic reactions: Enzymes. Homogeneous enzymatic kinetics. Michaelis-Menten kinetics. Determination of kinetic constants. Enzymatic inhibition.

## 4.4.Course planning and calendar

An approximate distribution of the hours of dedication to the different subjects, theory and practice sessions, is shown in Table 1. It is also indicated when students must submit the supervised works, once the corresponding topics are finished.

Table 1. Time distribution

| | Theoretical lectures and model exercises | Questions and exercises sessions | Programmed Works |
|---|---|---|---|
| Block 1. Introduction<br>Topic 1 | 2 | 0 | - |
| Block 2. Kinetics of homogeneous reactions<br>Topic 2 | 4 | 2 | Work 1 |

| | | | |
|---|---|---|---|
| Topic 3 | 2 | | |
| Topic 4 | 2 | 2 | |
| Topic 5 | 8 | 4 | |
| Topic 6 | 2 | 1 | Work 2 |
| First partial exam (3 h) | | | |
| Block 3. Kinetics of heterogeneous reactions | | | |
| Topic 7 | 2 | 1 | |
| Topic 8 | 8 | 4 | |
| Topic 9 | 3 | 2 | |
| Topic 10 | 4 | 2 | |
| Block 4. Kinetics of the enzymatic reactions | | | |
| Topic 11 | 3 | 2 | Work 3 |
| Total student hours | 40 | 20 | 20 |
| Second partial exam or final exam (3 h) | | | |

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the EINA website *( http://eina.unizar.es).*

### 4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=29922&year=2019