

Chemical Kinetics

Code: 102404
ECTS Credits: 6

Degree	Type	Year	Semester
2500897 Chemical Engineering	OB	2	2

Contact

Name: Teresa Gea Leiva
Email: Teresa.Gea@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

It is recommended to have obtained the fundamental knowledge of the subjects Balance in Chemical Engineering, Chemical Balance and Organic Chemistry.

Objectives and Contextualisation

The objectives of the Chemical Kinetics course are to acquire and consolidate the fundamental concepts of kinetic, stoichiometry and reaction mechanisms as well as homogenous kinetics and heterogeneous catalytic kinetic. In addition, the bases of the enzymatic kinetics will be introduced. However, it is intended to acquire the skills specified in this teaching guide.

Competences

- Analyse, evaluate, design and operate the systems or processes, equipment and installations used in chemical engineering in accordance with certain requirements, standards and specifications following the principles of sustainable development.
- Apply relevant knowledge of the basic sciences, such as mathematics, chemistry, physics and biology, and the principles of economics, biochemistry, statistics and material science, to comprehend, describe and resolve typical chemical engineering problems.
- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- Demonstrate knowledge of the different reaction, separation and processing operations for materials, and transport and circulation of fluids involved in the industrial processes of chemical engineering.
- Develop personal work habits.
- Develop thinking habits.
- Understand and apply the basic principles on which chemical engineering is founded, and more precisely: balances of matter, energy and thermodynamic momentum, phase equilibrium and kinetic chemical equilibrium of the physical processes of matter, energy and momentum transfer, and kinetics of chemical reactions
- Work in a team.

Learning Outcomes

1. Analyse a scientific study of the kinetics of a chemical reaction.
2. Analyse, evaluate, design and implement homogenous reactors.
3. Apply the concepts of heterogeneous catalytic chemical kinetics.
4. Apply the concepts of homogenous chemical kinetics.
5. Create diagrams to mathematically resolve and determine kinetic parameters.
6. Critically evaluate the work done.
7. Describe and apply the fundamental concepts of biological kinetics.
8. Develop a capacity for analysis, synthesis and prospection.
9. Develop critical thinking and reasoning
10. Develop scientific thinking.
11. Develop systemic thinking.
12. Identify, mathematically formulate and solve basic homogenous and heterogeneous chemical reaction problems.
13. Manage available time and resources. Work in an organised manner.
14. Use criteria to determine the control stage of heterogeneous catalytic processes.
15. Work cooperatively.

Content

1. Introduction. Fundamental concepts
 - 1.1. Types of chemical reactions
 - 1.2. Balance, kinetic and stoichiometry
 - 1.3. Stoichiometric model
 - 1.4. Reaction measurement of progress
 - 1.5. Concept of reaction speed
 - 1.6. Mechanism of reaction and kinetic model
2. Homogeneous kinetics
 - 2.1. Reactions in homogeneous media
 - 2.2. Dependence of concentration and temperature
 - 2.3. Determination of reaction velocity and kinetic equation
 - 2.4. Simultaneous reactions
3. Heterogeneous catalytic kinetics
 - 3.1. Catalysts. Materials and properties.
 - 3.2. Adsorption
 - 3.3. Kinetic models for catalyzed reactions by solids
 - 3.4. External and internal transfer of subject matter
 - 3.5. Methods to determine the controlling resistance
 - 3.6. Disabling solid catalysts

Methodology

The teaching methodology of this subject combines different elements: master classes and seminars; problem-based learning; analysis of scientific work; cooperative learning; performing oral presentations; peer evaluation; flipped classrooms.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem solving	15	0.6	2, 12
master class	32	1.28	2, 12
Type: Supervised			
Seminars	5.5	0.22	
Works	8	0.32	1
Type: Autonomous			
Problem solving	35	1.4	2, 12
Study	32	1.28	2, 1, 12
article searching	3	0.12	1
books and articles reading	4.5	0.18	1
tutorials	6	0.24	

Assessment

Process and evaluation activities programmed

The subject consists of the following evaluation activities:

1. Seminars and tests that can be evaluated

- First evaluable test PA1. Individual exercise 5% of the note.
- Second evaluated test PA2. Evaluable seminar, problem-based learning, problem solving in a collaborative way from individual pre-based work based on bibliographic examples. 10% of the mark of the subject
- Third test evaluable PA3. Submission of written work done in groups, carried out on a scientific article. Peer evaluation. 10% of the mark of the subject.
- Fourth PA4 assessable test. Seminar evaluable. Individual work Peer evaluation. 5% of the mark of the subject.
- Fifth assessable activity PA5. Flipped classroom 5% of the mark of the subject.

2. Partial examinations

- First partial exam EP1 on Topics 1 and 2. 35% of the mark of the subject
- Second partial exam EP2 on Lessons 3 and 4. 30% of the mark of the subject.

3. Entry Ticket

At the beginning of some classes fast tests will be made about the knowledge acquired in the previous classes. Success in these tests will result in a 5% bonus in the course mark.

Programming of evaluation activities

The scheduling of the assessment activities will be given on the first day of the subject and will be made public through the Virtual Campus. The following guidance is scheduled:

- PA1 week 3 of the subject
- PA2 week 5 of the subject
- EP1 week 8 of the subject

- PA3 week 11 of the subject
- PA4 week 13 of the subject
- PA5 week 15 of the subject
- EP2 June, once the classes have finished

Recovery process

The recovery of the subject will be done through a synthesis examination of the syllabus corresponding to the entire subject. Only those students with a minimum mark of 3 in the continuous assessment will be entitled to the recovery.

Procedure for the review of qualifications

For each assessment activity, a place, date and time of revision will be indicated in which the student will be able to review the activity with the teacher. In this context, claims can be made about the activity note, which will be evaluated by the teachers responsible for the subject. If the student does not submit to this review, this activity will not be reviewed later.

Qualifications

Honor enrollments Granting an honorific matriculation qualification is a decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be awarded to students who have obtained a final grade of 9.00 or more. It can be granted up to 5% of MH of the total number of students enrolled.

A student will be considered non-evaluable (NA) if it has not been presented in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject.

Irregularities by the student, copy and plagiarism

Notwithstanding other disciplinary measures deemed appropriate, the irregularities committed by the student that can lead to a variation in the rating of an evaluation act will be graded with a zero. Therefore, copying, plagiarizing, cheating, copying, etc. In any of the assessment activities it will imply suspending it with a zero. Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, without opportunity to recover it in the same course.

Evaluation of repeating students

After the second enrollment, the evaluation of the subject can be done through a synthesis test (90% of the mark) plus the delivery of a test equivalent to PA3 (10% of the mark) but carried out individually. In order to be able to opt for this differentiated evaluation, the repeating student must ask the teacher by email (teresa.gea@uab.cat) no later than 15 days after the start of the classes.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Seminars, works and evaluable tests	35%	3	0.12	1, 6, 7, 8, 13, 12, 15
Written evaluation tests	65%	6	0.24	2, 3, 4, 6, 10, 11, 8, 9, 12, 5, 14

Bibliography

Izquierdo, J.F., y col. "Cinética de las Reacciones Químicas". Ed. U.B., 2004.

Fogler, H.S. "Elements of Chemical Reaction Engineering", 4th ed., Prentice-Hall, 2005.

Levenspiel, O. "Chemical Reaction Engineering", 3rd. ed., John Wiley and Sons, 1999