UAB
Universitat Autònoma de Barcelona

Reactors II

Code: 106059
ECTS Credits: 6

2025/2026

Degree	Type	Year
Chemical Engineering	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Fundamentals of reactor design

Having attended the subjects on reaction kinetics and Unit operations

It is stronlgy recomended to have attended a subject on transport phenomena

Matlab fundamentals

Objectives and Contextualisation

Describe the dynamics of non-steady state and non-isothermal reactors by solving the corresponding material and energy balances.

Identify the essential elements, understand the operating characteristics and the basic tools for the design of multiphase reactors for chemical processes (material and energy balances). These reactors can include a gas phase or a solid phase.

Apply the mathematical tools necessary to design multiphase reactors and understand the different existing alternatives for their design.

Use of non-steady state reactor simulation software

Describe the differences between reactors that operate with an ideal flow regime and a real one.

Competences

- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- 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

Learning Outcomes

1. Analyse a scientific study of the kinetics of a chemical reaction.
2. Apply matter and energy balance to advanced continuous and discontinuous systems.
3. Apply the basic flow principles to chemical reactors.
4. Apply the basic principles on which chemical reactors are based.
5. Apply the concepts of heterogeneous catalytic chemical kinetics.
6. Apply the concepts of homogenous chemical kinetics.
7. Identify, analyse and resolve balances of matter in a stationary or non- stationary state, with or without a chemical reaction, in simple chemical processes.
8. Use criteria to determine the control stage of heterogeneous catalytic processes.

Content

Chapter 1 Design of reactors in non-steady state
1.1 Introduction to reactor design in ENE
1.2 Continuous Stirred Tank Reactor in ENE and in non-isothermal regime
1.3 Batch Reactor
1.4 Continuous Plug Flow Reactor
1.5 Distribution of Residence Time
1.6 Design of reactors with real flow regime

Chapter 2 Fluid/fluid reactors
2.1 Introduction to the design of multiphase reactors
2.2 Film theory with and without chemical reaction
2.3 Mass and energy balances in multiphase reactors
2.4 Correlations and design tools in fluid/fluid reactors

Chapter 3 Solid/liquid reactors
3.1 Introduction to solid/liquid reactor design
3.2 Integration of internal and external mass transfer problems in the design of multiphase reactors
3.3 Design of fixed bed reactors
3.4 Preliminary design of solid/liquid reactors other than the fixed bed
3.5 Preliminary design of three-phase reactors

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			

Seminars	5	0.2	1, 2, 5, 6, 3, 4, 7, 8
Theory Topic 1 - Design of reactors under non-steady state conditions	10	0.4	2, 3, 4, 7
Theory Topic 2 - Fluid/fluid reactors	10	0.4	2, 6, 3, 4, 7
Theory Topic 3 - Solid/Liquid Reactors	10	0.4	1, 2, 5, 6, 3, 4, 7, 8
Type: Supervised			
Practical class Topic 1	4	0.16	1, 2, 6, 3, 4, 7
Practical class Topic 2	5	0.2	1, 2, 6, 3, 4, 7
Practical class Topic 3	6	0.24	1, 2, 5, 6, 3, 4, 7, 8
Type: Autonomous			
Autonomous study of the subject	35	1.4	1, 2, 5, 6, 3, 4, 7, 8
Solving problems autonomously	47.5	1.9	1, 2, 5, 6, 3, 4, 7, 8
Task on reactor design	10	0.4	1, 2, 5, 6, 3, 4, 7, 8

Theory classes. The basic theoretical concepts are introduced in an orderly and concise manner for their subsequent practical development. Theory classes provide the necessary foundations for solid practical development. Students acquire key concepts, learn to think critically, and develop an understanding of the subject

Practical classes. A series of problems is selected from the collection of each topic. The step-by-step resolution of the most representative problems is shown and the resolution scheme for other problems is presented.

Seminars/task: Deepening the design of a reactor. Study of a specific reactor design process.

Moodle will be used as a virtual platform to communicate.

Note: 15 minutes of a class will be reserved, within the calendar established by the center/degree, for the complementation by students of the surveys evaluating the teaching staff's performance and evaluating the subject/module.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam Topic 1	30	2.5	0.1	2, 6, 3, 4, 7
Exam Topic 2	30	2.5	0.1	1, 2, 6, 3, 4, 7
Exam Topic 3	30	2.5	0.1	1, 2, 5, 6, 3, 4, 7, 8

Task on reactor design	10	0	0	1, 2, 5, 6, 3, 4, 7, 8

Assessment

This subject does not allow a single assessment method

a) Scheduled evaluation activities
The evaluation activities of the subject are detailed below with their percentage of weight on the final grade:
- Activity 1 (30%). Midterm exam 1 - Reactors in non-steady state.
- Activity 2 (30%). Midterm exam 2 - Fluid/fluid reactors.
- Activity 3 (30%). Midterm exam 3 - Solid/liquid reactors.
- Activity 4 (10%). Task on multiphase reactor design.

Each partial exam lasts about 2.5 hours and consists of a theory part and a problem.
In order to apply the calculation of the final grade, it is required:

- a minimum average of 3.0 for each partial exam.
- an average grade of midterm exams greater than 4.5.

If either of the two criteria is not met, the maximum final grade for the subject will be 4.0.

b) Recovery process
Students can take the recovery as long as they have taken a set of activities that
They represent a minimum of two thirds of the total grade for the subject. The recovery exam will include all the contents of the subject. This exam will consist of a theory part and several problems. The grade for this exam will replace the grade for activities 1-3 (partial exams).
A minimum of 4.5 on the exam will be required to apply this calculation.
In accordance with the coordination of the Degree and the management of the School of Engineering, the following activities cannot be recovered: evaluation activities of any type in which the students have committed an irregularity (described in section e).

c) Qualification review procedure
For each evaluation activity, a review place, date and time will be indicated in which students can review the activity with the teacher. In this context, complaints may be made about the grade for the activity, which will be evaluated by the teaching staff responsible for the subject. If the student does not attend this review, this activity will not be reviewed later.

d) Qualifications
Honor registrations. Awarding a grade of honors is the decision of the teaching staff responsible for the subject. UAB regulations indicate that MH may only be granted to students who have obtained a final grade equal to or greater than 9.00. Up to 5% MH of the total enrolled students may be awarded.

A student will be considered non-evaluable (NA) if she has not participated in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade for the subject.

e) Irregularities on the part of the students, copying and plagiarism
Without prejudice to other disciplinary measures that are deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an evaluation act will be graded with a zero.

Therefore, copying, plagiarism, deception, letting others copy, etc. in any of the evaluation activities will mean failing it with a zero. The evaluation activities graded in this way and by this procedure will not be recoverable and, therefore, the student will have the subject permanently suspended.

f) Evaluation of repeating students

The only change in the evaluation of the subject for repeating students is the possibility of maintaining the grades for activity 4 taken previously. This option must be communicated by email email to the responsible teacher, no later than 15 days after the start of classes.

Bibliography

Fogler, H. Scott. *Elements of Chemical Reaction Engineering / H. Scott Fogler, Ame and Catherine Vennema Professor of Chemical Engineering and the Arthur F. Thurnau Professor The University of Michigan, Ann Arbor*. Sixth edition. Boston: Pearson, 2022. Print.

Froment, Gilbert F, and Kenneth B Bischoff. *Chemical Reactor Analysis and Design / Gilbert F. Froment, Kenneth B. Bischoff*. 2nd ed. New York: John Wiley & Sons, 1990. Print.

Luyben, William L. *Process Modeling, Simulation, and Control for Chemical Engineers / W.L. Luyben*. 2nd ed. New York; McGraw-Hill, 1990. Print.

Trambouze, Pierre, Jean-Pierre Wauquier, and Hugo van Landeghem. *Chemical Reactors: Design, Engineering, Operation / Pierre Trambouze, Hugo Van Landeghem, Jean-Pierre Wauquier; Foreword by J. Limido; Translated from the French by Nissim Marshall*. Paris: Éditions Technip, 1988. Print.

Yeo, Yeong-Koo. *Chemical Engineering Computation with MATLAB / Yeong-Koo Yeo*. Boca Raton: CRC Press, 2017. Print.

Software

MATLAB

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	211	Catalan	first semester	morning-mixed
(SEM) Seminars	211	Catalan	first semester	morning-mixed
(TE) Theory	21	Catalan	first semester	morning-mixed