Universitat Autònoma de Barcelona

2020/2021

Advanced Chemical Reactors

Code: 102400
ECTS Credits: 3

Degree	Type	Year	Semester
2500897 Chemical Engineering	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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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

Other comments on languages

There are a lot of teaching materials in English

Prerequisites

It is highly recomended that the student has undertaken the following subjects

- chemical Reactor design
- Heat transfer processes
- Kinetics in chemical reactions
- Chemical Engineering Processes Modelling

Objectives and Contextualisation

The main objective is to design and retrofit real reactors, based on ideal reactors.

Part I- Non-ideal Flux

1. Design and discuss a Residence Time Distribution experiment
2. Build and discuss non-ideal flow models for chemical reactors.
3. Estimate the performance of a reactor based on its non-ideal flow model

Part II-fluid-fluid reactor

1. Understand the basis of mass transfer between two phases in the design of fluid-fluid reactors

2. Simulate and design fluid-fluid reactors. Analyze the behavior of fluid-fluid reactors under different operating conditions
3. Understand the basic design parameters of the fluid-fluid reactors.

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.
- 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 attitude.
- Develop personal work habits.
- Develop thinking habits.
- Observe ethics and professionalism.
- 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. Adapt to unforeseen situations.
2. Analyse, evaluate, design and implement homogenous reactors.
3. Apply knowledge of kinetics and thermodynamics to chemical reactors.
4. Apply matter and energy balance to advanced continuous and discontinuous systems.
5. Apply the basic flow principles to chemical reactors.
6. Apply the basic principles on which chemical reactors are based.
7. Describe non-ideal flow in chemical reactors.
8. Develop scientific thinking.
9. Maintain a proactive and dynamic attitude with regard to ones own professional career, personal growth and continuing education. Have the will to overcome difficulties.
10. Manage information by critically incorporating the innovations of ones professional field and analyse future trends.
11. Respect diversity in ideas, people and situations.
12. Work autonomously.

Content

Part I-Non-ideal Flux

1. Introduction. Ideal and real reactors.

2. Logistics of a RTD experiment.

3. RTD in ideal reactors.

4. Modeling of real reactors.

4.1. Models without parameters

4.2. Single-parameter models: Model with series tanks. Axial dispersion model.

4.3. Compartment Models.

5. Mixing in chemical reactors.

Part II-Fluid-fluid reactors

1. Model of the twp-film theory with/out chemical reaction.

2. Models of reactors.

3. Behavior of a reactor under different operating conditions

4. Design of fluid-fluid reactors. Semi-empirical correlations.

5. Fluid-fluid reactors. Types of reactors.

6. Preliminary guidelines to the design of solid/liquid reactors

Methodology

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Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Class Teaching	24	0.96	2, 4, 3, 5, 6, 7, 8, 10, 9
Type: Supervised			
Exam Part I	5	0.2	1, 4, 3, 5, 6, 7, 8, 12
Exam Part II	5	0.2	2, 4, 3, 6, 8, 12
Report Part I	10	0.4	4, 3, 5, 6, 7, 8, 12
Report Part II	10	0.4	2, 4, 3, 6, 8, 11, 12
Type: Autonomous			
Self study	21	0.84	1, 2, 4, 3, 5, 6, 7, 8, 10, 9, 11, 12

Assessment

The subject will be evaluated with two parts. Each one will include a report and an exam. It will be necessary to obtain a minimum of 4.0 in the weighted average of each part in order to be able to pass the subject. There is a retake exam designed for those students who have not passed either one or any of the two parts. The student can apply for a retake exam only when he/she has been taken a minimum of two thirds of the total activities of the subject. There is an exception: students who have already taken the subject previously A minimum mark of 0.1 is needed in each of the parts of the subject in order to pass the subject.

A student will be considered non-evaluable (NA) if he/she has not been taken a minimum of 60% of the total grade of the subject.

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. Any activity will not be reviewed after the revision day.

Honor grade is a decision of the teaching staff 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.

Notwithstanding other disciplinary measures deemed appropriate, the irregularities committed by the student that can lead to a variation in the evaluation act will be graded with a zero. Therefore, copying, plagiarizing, cheating, etc. will imply failure and grade if 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. In this case, the final grade of the subject will be zero.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam Part I	35	0	0	1, 4, 3, 5, 6, 7, 8, 12
ExamPart II	40	0	0	2, 4, 3, 6, 8, 12
Report Part I	10	0	0	4, 5, 6, 7, 8, 10, 9, 11
Report Part II	15	0	0	2, 4, 3, 6, 8, 12

Bibliography

Scott Fogler, H., "Elements of Chemical Reaction Engineering". 4th ed. (2005).

Levenspiel, O., "Chemical reaction engineering". 3rd ed. (1999).

Euzen, J-P., Trambouze, P., "Chemical reactors: from design to operation". (2004).

Mann, U. "Principle of Chemical Reactors Analysis and Design". (2011).

Missen, R., Mims, C.A., Saville, B.A. "Introduction to chemical reaction engineering and kinetics". (1998).