Universitat Autònoma de Barcelona

2023/2024

Analysis and Design of Chemical and Biological Reactors

Code: 43326
ECTS Credits: 6

Degree	Type	Year	Semester
4314579 Biological and Environmental Engineering	OB	1	2

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Francesc Gòdia Casablancas

Prerequisites

Any requirement

Objectives and Contextualisation

The main objective of the module is to perform advanced analysis and design of different types of reactors. The fundamental concepts of Chemical Engineering will be applied to the different biological and catalytic reactors with particular emphasis on reactors with immobilized biological catalysts. The module proposes to integrate kinetics, thermodynamics, transport phenomena and numerical methods to solve the models corresponding to the reactors. Likewise, simulation studies will be conducted to understand the sensitivity of the design parameters and to understand the operation of chemical and biochemical reactors.

Learning Outcomes

- CA08 (Competence) Integrate and abridge the information obtained from the scientific literature using the appropriate channels, contrasting and critically debating different alternatives.
- CA09 (Competence) Integrate knowledge of kinetics, thermodynamics, transport phenomena and numerical methods to analyse, design, model and optimise different types of reactors and their operating strategies.

- CA09 (Competence) Integrate knowledge of kinetics, thermodynamics, transport phenomena and numerical methods to analyse, design, model and optimise different types of reactors and their operating strategies.
- CA11 (Competence) Propose the corresponding mathematical simulation to conduct sensitivity studies and explain the operational results of chemical and bioreactors.
- CA12 (Competence) Assess the capacities of different biological reactors for their industrial application.
- KA08 (Knowledge) Distinguish between the fundamental concepts of Chemical Engineering in the different forms of reactor design and operation, including catalytic reactors and with special emphasis on reactors with immobilised biological catalysts.
- KA08 (Knowledge) Distinguish between the fundamental concepts of Chemical Engineering in the different forms of reactor design and operation, including catalytic reactors and with special emphasis on reactors with immobilised biological catalysts.
- SA10 (Skill) Build mathematical models for steady-state and non-steady-state processes.
- SA11 (Skill) Apply engineering concepts to the design and operation of heterogeneous, non-ideal, and catalytic reactors.
- SA12 (Skill) Calculate and categorise the different operational methods for chemical reactors and bioreactors, including work with immobilised enzymes and cells.

Content

1. ANALYSIS AND DESIGN of bioreactors:
Semicontinuous reactors. Fed-bacth operation. Sequential batch reactors.
Bioreactors with immobilized cells and enzymes
Reactors with membranes
Fotobioreactors
2. ADVANCED DESIGN OF CHEMICAL REACTORS
Biphasic reactors, liquid gas: bubbled columns
Biphasic reactors, solid liquid: catalytic reactors

Methodology

The classes are structured in two modules: in a first module, the design of biological reactors will be analyzed by means of scientific publications and the fundamentals of chemical engineering. In a second module, the mathematical models will be used to design of two-phase reactors

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Class Teaching	38	1.52	KA08, SA10, SA11, SA12, KA08
Self study	45	1.8	CA08, CA09, CA11, CA12, KA08, SA10, SA11, SA12, CA08
Type: Supervised			
Case studies	15	0.6	CA08, CA09, CA11, CA12, KA08, SA10, SA11, SA12, CA08

Type: Autonomous			
Advanced reactor design	20	0.8	CA09, CA11, SA11, SA12, CA09
Analysis of scientific papers	20	0.8	CA08, CA09, KA08, SA11, SA12, CA08

Assessment

The subject is divided into two well differentiated parts. You need to obtain a minimum of 4.0 in each of the parts to pass the course. There will be the possibility of retaking the written exam or the required homeworks with an extra synthesis exam.

For each evaluation activity, a place, date and time of revision will be indicated. If the student does not appear in this review, this activity will not be reviewed later.

Honors (MH): Granting a grade of honor registration is the decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be granted to students who have obtained a final grade equal to or greater than 9.00. You can grant up to 5% of MH of the total number of students enrolled.

A student will be considered non-evaluable (NA) if he/she has not been submitted to 50% of the evaluation activities

Copying, plagiarism, cheating, etc. in any of the evaluation activities will result in a fail and grade of zero.

This subject does not offert single assessment.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Advanced reactor design	17.5%	0	0	CA08, CA09, CA11, SA10
Advanced reactor design (II)	17.5%	0	0	CA08, CA09, CA11, SA10, SA11
Report on a scientific paper	35 %	9	0.36	CA08, CA09, CA12, KA08, SA12
Written exam	30%	3	0.12	CA08, CA09, CA11, CA12, KA08, SA10, SA11, SA12

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).

Software

Advanced MS Office and MATLAB requirements