Universitat Autònoma de Barcelona

2022/2023

Basic Chemical Engineering

Code: 106050
ECTS Credits: 9

Degree	Type	Year	Semester
2500897 Chemical Engineering	OB	1	A

Contact

Name: Francisca Blánquez Cano
Email: paqui.blanquez@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

Teachers

Gloria González Anadón
Francisca Blánquez Cano

Prerequisites

Minimum knowledge required to take the subject:
Differential and integral calculus (baccalaureate level)
Linear algebra (baccalaureate level)
It is recommended to take the propedeutic courses if you do not have the required level

Objectives and Contextualisation

The objectives of the course are first of all that the student acquires the basic concepts that are related to carry out an industrial process and then familiarize with the mathematical tools that will be the starting point for the analysis of processes.

During the first semester, the study of matter and energy balances, which are the most frequently performed by a chemical engineer throughout his professional life, is carried out.

During the second semester an introduction to transport phenomena that govern the unit operations processes is carried out.

Competences

- Develop personal work habits.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.

- 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. Apply and identify basic concepts related with chemical engineering.
2. Apply and identify the macroscopic equilibrium of momentum.
3. Apply and identify velocity equations in molecular transport.
4. Develop independent learning strategies.
5. Identify, analyse and resolve balances of energy in simple chemical processes.
6. Identify, analyse and resolve balances of matter in a stationary or non- stationary state, with or without a chemical reaction, in simple chemical processes.
7. Obtain and apply the design equations for ideal isothermal reactors.
8. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
9. Work cooperatively.

Content

Teme 1.-Introduction
The chemical process industry. Definitions: process, unit and system. Operation in discontinuous and continuous. Stationary and non-stationary state

Teme 2.- Macroscopic balance of matter in systems without chemical reaction
2.1 Concept of balance. Total material balance
2.2 Material balance of a single component. Balances of matter in steady state
2.3 Processes with recirculation, purge and bypass currents
2.4 Balances of matter in a non-stationary state

Teme 3.- Macroscopic balance of matter in systems with chemical reaction
3.1 Estequimetry. Degree of conversion Other parameters: reactive limitant, performance and selectivity
3.2 Application of material balances to processes with chemical reaction

Teme 4.- Ideal reactors

4.1 Reaction rate. Dependence on concentration and temperature
4.2 Ideal reactors: obtaining the design equations for ideal isothermal reactors

Teme 5.- Macroscopic balance of energy
5.1 Total energy balance. Energy associated with the mass and not associated
5.2 Steady-state energy balance
5.3 Energy balance in a non-steady state
5.4 Balance of heat energy

Teme 6.- Introduction to transport phenomena

6.1 Property transport mechanisms

6.2 Rate equations: Fourier, Fick and Newton equations

6.3. Reology

6.4 Transport properties determination

Teme 7.- Molecular transport

7.1 Heat and matter transfer at stationary state. Systems with and without generation.

7.2 Non-stationary transport: Graphical solutions

Teme 8.- Transport individual coefficients

8.1 transport throughout interficies: friction factor and heat and matter individual transport coefficients

Methodology

Theory classes: One group. Confirm days and classrooms for each group on the school website.

Problem classes: Students are divided into two groups. Confirm days and classrooms for each group on the school website. A list of problems and solutions for each teme will be published on the virtual campus. Problems solving will be done in class and problems will be proposed to be solved by the students.

Seminars: Students are divided into two groups. Confirm the days and classrooms of each group on the school website. Reinforcement of theory and problems. Problems and practical questions may be proposed to solve in class, and they will be delivered at the end of the class.

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			
Problem classses	23	0.92	1, 2, 3, 4, 5, 6, 7, 8
Seminars	7	0.28	1, 2, 3, 4, 5, 6, 7, 8, 9
Therory classes	46	1.84	1, 2, 3, 5, 6, 7
Type: Supervised			
resolution and correction of problems	25	1	1, 2, 3, 4, 5, 6, 7, 8, 9
Type: Autonomous			
Problems resolution	30	1.2	1, 2, 3, 4, 5, 6, 7, 8, 9
Study	65	2.6	1, 2, 3, 4, 5, 6, 7, 9
Tutorship	6	0.24	4, 9

Assessment

Continuous evaluation:

· partial tests (90% of the total note)

1st partial test: Temes 1, 2 and 3. (30% note).
2nd partial test: Teme 4 and 5. (30% note).

3rd partila test: Temes 6,7 and 8. (30% note).
These tests will consist of theory questions and problem solving. For the part of problems you can consult class notes and books, but not solved problems neither of class nor of books of collections of problems.

Minimum score of each part to pass the continuous assessment 3/10.

· Work delivered in Seminars: 10% note. The student is responsible of the returned work. The student should keep the original work untill the end of the course, to solve possible errors in case it is necessary.

Retaking final test:

The students who do not pass the subject by continuous evaluation (5/10), can ratake only the partial tests failed (note under 5/10).

The retake test of each partial test will account the same percentage than in continuous evaluation. The notes of the passed partial tests are maintaned, as well as the seminaris note.

Students that passed the subject by continuous evaluation can not attent the retaking test to increase the mark.

Exam dates: School web and/or Campus virtual

To pass the subject a 5/10 note is necessary

In no case will exams (evaluation tests) be carried out on days and times different from those officially published in the School Web

Important observation: Without prejudice toother disciplinary measures deemed appropriate, and in accordance with current academic regulations, will be scored with a zero theirregularities committed by the student that may lead to a variation of the rating of an evaluation act . Therefore, plagiarizing, copying or allowing an evaluation activity to be copied, or falsifying any evaluation activity will imply suspending with a zero and can not be recovered in the same academic year. If thisactivity has a minimum associated grade, then the subject will be suspended.

Qualification review procedure
For each evaluation activity, a place, date and time of revision in which the student can review the activity with the teacher will be indicated. In this context, claims may be made on the activity grade, which will be evaluated by the faculty responsible for the subject. If the student does not appear in this review, this activity will not be reviewed later.

Qualifications
Honor plates. 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 not evaluable (NA) if he has not been presented in a set of activities the weight of which equals a minimum of two thirds of the total grade of the subject.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Partial test 1	30%	4	0.16	1, 6, 8
Partial test 2	30%	4	0.16	1, 5, 6, 7, 8

Partial test 3	30%	4	0.16	1, 2, 3, 8
Seminars	10%	5	0.2	1, 2, 3, 4, 5, 6, 7, 8, 9
retaken test	90%	6	0.24	1, 2, 3, 5, 6, 7, 8

Bibliography

- AUCEJO, A. i col. (2013)

"Introducció a l'Enginyeria Química" Ed. Universitat de València.

- HIMMELBLAU, D. M., (1997)

"Principios Básicos y Cálculos en Ingenieria Química" (2a ed.), Ed. Prentice Hall.

- FELDER R.M. I ROUSSEAU R.W., (1991)

"Principios Elementales de los Procesos Químicos", (2a ed.) Ed. Addison-Wesley Iberoamericana.

- FOGLER, H.S., (1998)

"Elements of Chemical Reaction Engineering", (3ª ed.) Ed. Prentice-Hall.

- IZQUIERDO J.F. i col (2011)

"Introducción a la Ingenieria Química: Problemas resueltos de Balances de Materia y Energia" Ed. Reverté

Electronic books

-Concepts of chemical engineering for chemists / edited by Stefaan J.R. Simons

-Coulson & Richardson's chemical engineering. Vol. 1, Fluid flow, heat transfer and mass transfer / J.M. Coulson and J.F. Richardson with J.R. Backhurst and J.H. Harker

-Chemical engineering : solution to the problems in chemical engineering [Recurs electrònic] / by J. R. Backhurst and J. H. Harker ; with J. F. Richardson

-Basic principles and calculations in chemical engineering / David M. Himmelblau, James B.Riggs

Software

MS Office (word, power point, excel)