Universitat Autònoma de Barcelona

2017/2018

Basic Chemical Engineering

Code: 102492
ECTS Credits: 6

Degree	Type	Year	Semester
2502444 Chemistry	OB	2	1

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: Yes

Other comments on languages

Key specific terms for the course will be given in Catalan, Spanish and English

Teachers

Adriana Artola Casacuberta

Prerequisites

No official requirements are defined for this course. However, we strongly recommend that the student has passed the first year courses Chemistry Fundamentals and Mathematics.

Objectives and Contextualisation

The general aim in this course is that the student gains skills allowing for identification, mathematical formulation and problem solving of basic problems in Chemical Engineering. Specifically, the student has to be able of:

- Building and solving mass and energy balances in systems with and without chemical reaction under diverse conditions of operation (continuous/batch, steady state/transient state)
- Conducting basic design of chemical reactors operating in continuous and batch mode, under isothermal or adiabatic conditions
- Acquiring basic notions of the unit operations in chemical engineering and their application at industrial level

Skills

- Apply knowledge of chemistry to problem solving of a quantitative or qualitative nature in familiar and professional fields.
- Be ethically committed.

- Communicate orally and in writing in ones own language.
- Evaluate the health risks and environmental and socioeconomic impact associated to chemical substances and the chemistry industry.
- Handle chemical products safely.
- Handle standard instruments and material in analytic and synthetic chemical laboratories.
- Have numerical calculation skills.
- "Interpret data obtained by means of experimental measures, including the use of IT tools; identify their meaning and relate the data with appropriate chemistry, physics or biology theories."
- Learn autonomously.
- Manage, analyse and synthesise information.
- Manage the organisation and planning of tasks.
- Propose creative ideas and solutions.
- Reason in a critical manner
- Resolve problems and make decisions.
- Show an understanding of the basic concepts, principles, theories and facts of the different areas of chemistry.
- Show initiative and an enterprising spirit.
- Use IT to treat and present information.
- Use the English language properly in the field of chemistry.
- Work in a team and show concern for interpersonal relations at work.

Learning outcomes

1. Analyse equations representing experimental measurements made in the laboratory.
2. Be ethically committed.
3. Calculate matter and energy balances.
4. Communicate orally and in writing in ones own language.
5. Define the concepts and principles of the industrial chemical processes.
6. Describe the concepts and principles of transport mechanisms.
7. Describe the principles for operating chemistry reactors and the basic operations.
8. Design a distillation system.
9. Design chemical reactors.
10. Establish the principles of matter and energy balance.
11. Handle equipment and materials applied to the experimental study of matter and energy balances.
12. Have numerical calculation skills.
13. Identify and evaluate the environmental impact associated to industrial chemistry processes.
14. Interpret experimental measurements made in the laboratory.
15. Learn autonomously.
16. Manage, analyse and synthesise information.
17. Manage the organisation and planning of tasks.
18. Propose creative ideas and solutions.
19. Reason in a critical manner
20. Resolve problems and make decisions.
21. Safely handle the experimental facilities used in chemical engineering.
22. Show initiative and an enterprising spirit.
23. Use English terminology in industrial chemistry processes.
24. Use IT to treat and present information.
25. Work in a team and show concern for interpersonal relations at work.

Content

1. Chemical process and chemical industry. Introduction to Chemical Engineering.

2. Mass and energy balances. Total mass balance. Mass balance without chemical reaction at steady state. Mass balance without chemical reaction in transient state. Mass balance with chemical reaction. Total energy balance. Mechanical energy balance. Heat energy balance.

3. Chemical reactor design. Reaction rate. Stirred batch reactor. Continuous stirred tank reactor. Plug flow reactor. Comparing ideal

reactors. Adiabatic conversion for steady state systems.

4. Unit operations. Operations based on movement transport. Operations based on energy transport. Operations based on mass transport.

Methodology

Lectures: students receive a set of, on one hand, theoretical concepts, and on the other hand practical skills for solving examples or easy problems. This learning will provide the basics for understanding the course, problem solving and laboratory practicals.

Workshops: In these sessions the students will practice the concepts and skills acquired during the lectures. Small groups will easy the participation of the students in the problem solving process.

Laboratory practicals: familiarization with the experimental methods used in Chemical Engineering to learn how to operate equipment of industrial application.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Lectures	27	1.08	5, 6, 7, 9, 8, 23, 10, 13, 19
Problems whorkshop	10	0.4	15, 9, 8, 23, 3, 16, 18, 19, 20, 12, 24
Type: Supervised			
Laboratory practicals	20	0.8	1, 23, 14, 21, 18, 20, 25
Practicals report writing	20	0.8	15, 4, 7, 3, 10, 16, 14, 19, 20, 12, 25, 24
Type: Autonomous			
Problem solving	50	2	15, 16, 17, 19, 20, 12, 24
Team working	15	0.6	15, 4, 9, 23, 3, 16, 17, 19, 20, 12, 25, 24

Evaluation

1. Individual grade: in this part the acquired skills will be evaluated for both theoretical concepts and problem solving.
The student can choose between obtaining the final grade from the marks of the partial exams or from the final test.

1.1. Two partial exams: each partial exam will contain problem solving and theoretical questions.

1.2. Final test: it consists of problem solving and theoretical questions covering the whole course.

2. Grading assigned problems: Problem solving for some specific problems will be graded as 10 % of the final course mark.

3. Practical grading: The laboratory practicals are of mandatory attendance. They will be grade with a written report derived from the laboratory experiments and it will consist of a multiplicative factor applied to the final course score. This coefficient ranges from 0.9 to 1.1.

Student passing the course: Students will pass the course with a final score of 5/10.

The qualification **Not gradable** will be given to students who did not pass the course with the partial exams and not attending to the final test.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Final Test	0.9	2	0.08	1, 4, 5, 6, 7, 9, 23, 3, 10, 19, 20, 12
Partial Exam II	0.5*0.9	3	0.12	4, 5, 6, 7, 23, 10, 19
Partial Test I	0.5*0.9	3	0.12	9, 8, 3, 10, 16, 19, 20, 12
Practicals report	Multiplicative factor [0.9-1.1]	0	0	1, 15, 4, 23, 13, 14, 11, 21, 18, 19, 12, 25, 24
Team working	0.1	0	0	15, 22, 9, 3, 16, 17, 2, 19, 20, 12, 25, 24

Bibliography

AUTHOR Aucejo A., Benaiges D., Berna, A., Sanchotello M., Solà C.

TITTLE Introducció a l'Enginyeria Química

PUBLISHED Pòrtic. Biblioteca Universitària. 1ª ed. Barcelona (1999).

AUTHOR Himmelblau D.M.

TITTLE Balances de materia y energía

PUBLISHED Prentice-Hall Hispanoamericana. 4ª ed. México (1988).