Universitat Autònoma de Barcelona

2019/2020

Fluid Dynamics

Code: 102414
ECTS Credits: 6

Degree	Type	Year	Semester
2500897 Chemical Engineering	OB	2	2

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

Prerequisites

Convenient to have studied the subject 102405 Mass and energy balance in chemical engineering.

Objectives and Contextualisation

The main objective is to select and design equipment based on the circulation of fluids existing in any industrial plant.

Other more specific objectives:
• Apply the mechanical energy balance to the study of the fluid flow.
• Study and dimension the equipment for the transport of incompressible fluids.
• Know the necessary instrumentation or based on the fluid flow.
• Expand the application of the mechanical energy balance to the circulation of compressible fluids.
• Understand the foundation of unit operations based on the fluid flow.
• Design the equipment of the most relevant unit operations.

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.
- Apply relevant knowledge of the basic sciences, such as mathematics, chemistry, physics and biology, and the principles of economics, biochemistry, statistics and material science, to comprehend, describe and resolve typical chemical engineering problems.
- Communication
- 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.
- Objectively compare and select different technical options for chemical processes.

- 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. Apply knowledge of mathematics, physics and material science to the dimensioning of fluid circulation systems.
2. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
3. Describe the operations for the transport and circulation of fluids involved in the industrial processes of chemical engineering.
4. Develop a capacity for analysis, synthesis and prospection.
5. Develop curiosity and creativity.
6. Develop independent learning strategies.
7. Develop scientific thinking.
8. Efficiently analyse, evaluate and design equipment and installations for the circulation of fluids.
9. Efficiently use ICT for the communication and transmission of ideas and results.
10. Identify, analyse and resolve mechanical energy and matter balances.
11. Manage available time and resources. Work in an organised manner.
12. Objectively compare and select different technical alternatives for fluid circulation systems.
13. Work autonomously.

Content

1.- Introduction
2.- Incompressible fluids
2.1.- Installations for the transport of fluids
2.1.1.- Pipe fittings and valves
2.1.2.- Materials
2.2.- Balance of mechanical energy
2.2.1.- Simplified forms
2.2.2.- Evaluation of the mechanical energy loss
2.2.3.- Applications of the mechanical energy balance
2.3.- Transportation of incompressible fluids: pumps
2.3.1.- Head and NPSH
2.3.2.- Classification and description of pumps
2.3.3.- Characteristic curve of a centrifugal pump
2.4. Measurers of flow rate and pressure

3.- Compressible fluids
3.1.- Balance of mechanical energy
3.1.1.- Isotherm circulation
3.1.2.- Adiabatic circulation
3.2.- Measurers of gas flow rate
3.3.- Transport of compressible fluids
3.3.1.-Classification of equipment: fans, blowers and compressors
3.3.2.- Calculation of the compressor power
4.-Operations based on the flow of fluids
4.1.- Circulation of a fluid around a solid
4.2.- Fixed beds
4.3.- Fluidised beds
4.4.- Filtration
4.5.- Sedimentation

Methodology

Lectures where the fundamentals of fluid circulation will be exposed.
Solve problems class to apply the foundations to specific cases.
Search of information related to the description of equipment by the students.
Completion by the students of numerical project of an fluid flow installation.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Equipment calculation	15	0.6	8, 12
Theoretical foundations	30	1.2	8
Type: Supervised			
Equipment selection	10	0.4	12
Type: Autonomous			
Problem solving	45	1.8	8, 12, 2, 11
Study	25	1	12
To find information	10	0.4	12, 3

Assessment

The subject is divided into two parts: part A (block 1 and 2) and part B (block 3 and 4).
a) The evaluation activities and the percentage of the final mark are calculated according to the expression: Final mark = 0.25 * Exam A + 0.25 * Exam B + 0.25 Numerical project + 0.08 * multiple choose exam + 0.07 solved problems + 0.10 * descriptive work
To pass the Exams A and the B, 50% of the mark must be achieved, on the contrary the exam must be repeated.

Each exam will contain a part of theory and a part of problems. Only the part of problems will be corrected if you get a grade greater than or equal to 40% in the theory part.

The team description work is optional in groups that the teacher makes of 2-3 people.
Project work consists of designing a simple installation for a fluid flow circulation. The work is done cooperatively in teams established by the teacher.

b) Programming of the evaluation activities
Equipment description works will be delivered during week 3 and will be corrected as the theory advances.
Multiple choose exams (10) with (7-15) questions about the equipment will be performed through the Moodle classroom a week after uploading the description work of the corresponding teams.
During the semester it will be requested that some resolved problems be submitted that will be corrected in the co-evaluation system and for the teacher.
Numerical project statement will be provided during week 3 and the first version of the work will be delivered during week 7 and the final version during week 10.
Exam A will be done during week 8.
Exam B test will be week 20.
c) Recovery process

Exams A and B may be recovery only if the numerical project score exceeds 35%.
d) Procedure for the review of qualifications
For each Exam and retrieval, the date, time and place will be indicated whenthe notes are published.

e) Qualifications
The regulations of the UAB indicate that Honor Grade only be awarded to students who have obtained a final grade of 9.00 or more. It can be granted up to 5% of Honor Grade of the total number of students enrolled.
To obtain a HG it is essential to obtain a good qualification in the 1st version of the numerical project and to carry out a task of leader in the work team.
f) Iregularities by the student, copy and plagiarism.
Without prejudice to other disciplinary measures considered appropriate, the irregularities committed by the student that can lead to a variation in the rating of an evaluation act will be qualified with a zero. Therefore, copying, plagiarizing, cheating, copying, etc. In any of the assessment activities it will result in fail it with a 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.
The copy may be detected during the exam, but especially during the correction, so that actvity with equal versions will be annulled.
In cooperative work, it is recommended to denounce "jetas" and "mantas" that hurt their development. As of the complaints, measures that may entail the expulsion of the group and therefore the impossibility of passing the subject during the same course will be pending.
h) Evaluation of the repeaters.
No activity mark of previous course will be maintained.
From the 2nd enrollment, the student will opt for a simplified assessment if he is notified during the first 2 weeks of the semester.
The simplified assessment consists in
Final grade = 0.3 * A + 0.3 exam* B + 0.25 numerical project + 0.15 * multiple choose exams.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery solved problems	7%	3	0.12	8, 1, 3, 7, 4, 11, 10, 13
Equipment description work	10%	1	0.04	12, 3, 9, 11, 13
Exam A	25 %	2	0.08	8, 12, 3
Exam B	25 %	2	0.08	8, 12, 3
Multiple choose exams about equipments	8%	1	0.04	12, 7, 6, 11
Numerical project	25 %	2	0.08	8, 1, 12, 2, 7, 6, 4, 5, 9, 11, 10, 13
Recovery Exam A	25 %	2	0.08	8, 12, 3
Recovery Exam B	25 %	2	0.08	8, 3, 10

Bibliography

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