UAB
Universitat Autònoma de Barcelona

Fluid Dynamics

Code: 102414
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500897 Chemical Engineering	OB	2

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

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

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

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Equipment calculation	15	0.6	9
Theoretical foundations	30	1.2	
Type: Supervised			
Equipment selection	10	0.4	9
Type: Autonomous			
Problem solving	45	1.8	1, 8, 9
Study	28	1.12	9
To find information	10	0.4	2, 9

The fundamentals will be introduced by videos and teaching material.

Class will be dedicated to apply concepts to case studies and to solve questions.

Concepts will be applied also to solve selected problems.

Search of information related to the description of equipment by the students.
During lectures students will complete a numerical project of fluid flow installation.

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam block A	30%	2	0.08	2, 3, 7
Examen block B	30%	2	0.08	2, 3, 7, 8, 9
Multiple choise exams about equipments	10%	1	0.04	3, 4, 5, 6, 8, 9
Numerical project	20%	1	0.04	1, 3, 4, 5, 6, 7, 8, 9, 10
Recovery Exam A	30%	2	0.08	2, 9
Recovery Exam B	30%	2	0.08	2, 7

Seminars	10%	2	0.08	2, 3, 7, 8, 10	

The subject is divided into two parts: part A (topics 1 and 2) and part B (topics 3 and 4).

The assessment activities are:

1) test-type questions (multiple choice) on equipment description works

2) Seminar where a problem will have to be solved

3) Completion of a numerical work independently or with tutoring + exam

4) Exam block A (1st term) and exam block B (2nd term)

The final grade will be calculated according to the expression:

Final grade = 30% block A + 30% block B + 10% seminars + 10% tests + 20% numerical work.

To pass block A and block B you need to get 50% between the theory exam and the problems, otherwise you will have to recover the block not passed.

To calculate the final grade, you must obtain a minimum of 40% in each of the 4 assessable items.

For each exam, the problem will only be corrected if the theory grade is equal to or higher than 40%.

b) Programming of assessment activities

The calendar of assessment activities will be published on the Virtual Campus

c) Recovery procedure

No requirements

d) Qualification review procedure

For each test and retakes, the day, time and place will be indicated when the notes are published.

e) Qualifications

UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9.00. Up to 5% of MH of the total number of enrolled students can be awarded.

No Evaluable will be assigned to the student who has not deliverd one of the main items (numerical work, exam block A or exam Block B)

f) Irregularities by the student, copying and plagiarism.

Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a change in the grade of an assessment act will be graded with a zero. Therefore, copying, plagiarism, deception, allowing copying, etc. in any ofthe assessment activities will involve failing 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, with no opportunity to recover it in the same course.

The copy may be detected during the test, but especially during the correction, so that activity with identical versions will be cancelled.

h) Evaluation of repeaters.

No marks are saved for any assessment activities from previous courses.

Bibliography

J.M. Coulson, J.F. Richardson Chemical Engineering, V. 1 (1991), V. 6 (1983) Pergamon Press

W.L. Mc Cabe, J.C. Smith, P. Harriot Unit Operations of Chemical Engineering, 4th edition.McGraw-Hill Book Company, New York (1985)

E. Costa Novella Ingeniería Química 3. Flujo de fluidos. Alhambra Universidad, Madrid (1985)

R.H. Perry, D. Green Perry's Chemical Engineers' Handbook, 6th edition McGraw-hill, New York (1984)

O. Levenspiel Flujo de Fluidos. Intercambio de Calor Ed. Reverté, Barcelona (1993)

F.M. White Fluid Mechanics, 3th edition. McGraw-Hill, New York (1994)

N. de Nevers Fluid Mechanics for Chemical Engineers, 2nd edition. McGraw-Hill, New York (1991)

R. Darby Chemical Engineering Fluid Mechanics. Marcel Dekker, New York (1996)

Robert L. Mott Mecànica de fluidos aplicada, 4ª edición, Prentice Hall, Mèxico (1996)

Through the library, electronic versión is available.

Ch. J. Geankoplis Transport Processes and Unit Operations, 3ª edición, Prentice Hall, New Jersey (1993)

Software

No special software

Language list

Information on the teaching languages can be checked on the CONTENTS section of the guide.