UAB
Universitat Autònoma de Barcelona

Fluid Dynamics

Code: 106048
ECTS Credits: 9

2024/2025

Degree	Type	Year
2500897 Chemical Engineering	OB	2

Contact

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Teaching groups languages

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

Prerequisites

To have attended the subject Chemical Engineering Fundamentals

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.
- Consolidate theoretical concepts through experimentation in laboratory assemblies.

Competences

- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- Assume the values of professional responsibility and ethics required in chemical engineering.
- Develop personal attitude.
- 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 scientific method to perform macroscopic balances of matter, energy and momentum.
2. Identify, analyse and resolve mechanical energy and matter balances.
3. Maintain a proactive and dynamic attitude with regard to one's own professional career, personal growth and continuing education. Have the will to overcome difficulties.
4. Perform a critical analysis of experimental results and of the overall work done.
5. 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.
6. Work autonomously.
7. Work cooperatively.

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

Lab work:

- Mechanical energy balance
- Loss of load in accidents
- Fixed / fluidized beds
- Rotodynamic machines
- Filtration

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lab work	35	1.4	3, 4, 7
Numerical work	5	0.2	1, 2, 3, 7
Problem solving in class	40	1.6	1, 2, 3, 7
Type: Supervised			
Equipment selection	10	0.4	3, 4, 5
Mentoring	4	0.16	3, 4, 5
Type: Autonomous			
Finding information	10	0.4	3, 5, 6
Lab work report	35	1.4	3, 4, 5, 6
Study	55	2.2	3, 5, 6
Theoretical fundamentals	20	0.8	

The fundamental concepts will be presented through videos and teaching material on the Virtual Campus.

The classes will require the active participation of the students who will have to apply the concepts to specific cases and the doubts will be resolved.

Problem classes will be used to solve model problems.

Students will have to study autonomously the reports of equipment description and will have to answer the questions formulated through questionnaires of the virtual Campus

Completion (mostly in class) by students of a numerical detail work of an 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
Block B exam	20 %	2	0.08	1, 2, 5
Equipment selection (multiple choice exams)	10 %	1	0.04	3, 5, 6
Exam block A	20 %	2	0.08	1, 2, 5
Lab work	20 %	1	0.04	3, 4, 6, 7
Numerical work	15 %	1	0.04	1, 3, 4, 7
Seminars	15 %	4	0.16	1, 3, 4, 6, 7

The subject is divided into three parts: part A (topics 1 and 2), part B (topics 3 and 4) and part C (laboratory exercises)

The activities to be evaluated are:

- A consistent numerical work in designing a simple installation through which a fluid circulates + examination, unrecoverable.
- Test-type tests on team selection formulated through the Virtual Campus, unrecoverable.
- 3 Seminars that consist of solving 1 problem, unrecoverable.
- 2 Partial tests (Ai B)
- Practices (reports + exam)

The final grade will be calculated according to the expression:

Final grade = 20% test A + 20% test B + 10% tests + 15% numerical work + 15% seminars + 20% practicals.

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.

Each test will have a theory part and a problem part. Only the problem part will be corrected if a mark greater than or equal to 40% is obtained in the theory part.

To calculate the final grade, you must obtain a minimum of 40% in each of the main items (test A, test B and practicals).

b) Practicals

A notebook is required

The practice block is evaluated as follows: 75% reports, 15% exam, 10% laboratory (behavior in the laboratory, having read the script, attendance, etc.)

To be able to average the practice block, you must get at least a 3 in the exam.
In order to be able to average the practice block, at least a 4 must be subtracted from the average of the reports.
Unexcused absences subtract 1 point from the laboratory grade.
Arriving late unjustifiably subtracts 0.5 points from the laboratory grade.

c) Programming of assessment activities

Evaluable activities will be announced through the Virtual Campus.

d) Recovery procedure

No requirements

e) Qualification review procedure

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

f) 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.

g) 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 of the 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.

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, 4^{th} 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, 6^{th} 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)

A través de la biblioteca se puede consultar la versión electrónica.

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

Software

No special software

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	211	Catalan	annual	morning-mixed
(PAUL) Classroom practices	212	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	211	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	212	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	213	Catalan	annual	morning-mixed
(SEM) Seminars	211	Catalan	annual	morning-mixed
(SEM) Seminars	212	Catalan	annual	morning-mixed
(TE) Theory	21	Catalan	annual	morning-mixed