COURSE: FLUID DYNAMICS

SUBJECT MATTER: Fluid Dynamics
MODULE: Process and Product Engineering
PROGRAM: Master in Chemical Engineering

GENERAL FEATURES*

Type: ☑ Compulsory
Duration: Semester **Semester/s**: 1
Number of ECTS credits: 3
Language/s: English, Catalan, Spanish.

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION (of the meaning of the course in relation to the studies. Between 100 and 200 words)

Fluid dynamics is a fundamental discipline of chemical engineering, covering everything from transport fluid to aerodynamics, through fluid machines and hydraulic circuits, to name a few examples. This course focuses on establishing the basis for the future engineer knows the basic principles of both the static and the fluid dynamics and apply them in specific cases, such as design of tanks and dams, pipe flow, pump design and design wings and spoilers.

COMPETENCES (of the course placed in relation to the pre-assigned competences in the subject matter)

CB6 – The student has knowledge and understanding of what constitutes a basis or an opportunity to be original by developing and/or applying ideas, often in a research context.
CB7 - The student can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to his/her field of study.
CG1-The student can design, manage, execute and expose a project.
CE1-The student is able to apply knowledge of mathematics, physics, chemistry, biology and other natural sciences – obtained through study, experience and practice – with critical reasoning to establish economically viable solutions to technical problems.
CE2 - The student can design products, processes, systems and services for the chemical industry as well as optimize other already developed, on the technological basis the various areas of Chemical Engineering, involving processes and transport phenomena, separation operations and reactor engineering, both chemical and nuclear, electrochemical or biochemical.
CE4 - The student has the ability to solve problems that are unfamiliar, incompletely defined, and have contradictory specifications, considering the possible methods of solution, including the most innovative, selecting the most appropriate, being able to correct implementation and evaluating the different design solutions.

PREVIOUS REQUIREMENTS * (modules, subject matters, courses or knowledge necessary for the follow-up of the subject. State previous courses required to be completed)

The competencies of the fundamental module.

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CONTENTS (List the content of the course, with up to two level detail)

1. Introduction to Fluid Dynamics
2. Basic Concepts
2.1. Density, Viscosity, Surface Tension
2.2. Pressure, Speed, Shear Tension
2.3. equipment
3. Fundamental equations.
3.1. Conservation laws
3.2. Bernoulli equation and energy equations
3.3. Navier-Stokes equations
4. Duct flow
4.1. Turbulence and boundary layer
4.2. Turbulence modeling
4.3. Loss of load in pipes
4.4. Design of turbomachinery
4.5. Pipe networks
4.6. Flow in open channels
5. Flow around objects.
5.1. Turbulence and boundary layer
5.2. Bodies straight and rectilinear
5.3. Flow separation
5.4. Calculation of friction forces
5.5 Flow in fluidized beds

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METHODOLOGY

LEARNING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and competences.)

Learning Activities	ECTS Credits	Competences
Lectures	0.8	CB6, CE3
Case and Problem-Solving Sessions	0.4	CG1, CE1, CE2, CE3, CE4
Laboratory	0.3	CB7, CG1, CE1, CE3, CE4
Personal Study	1.4	CB6, CB7, CE1, CE2, CE3
Assessment Tasks (Exams, Continuous Assessment...)	0.1	CB6, CB7, CE1, CE2
TOTAL	**3.0**	

TEACHING METHODOLOGY (justify the teaching methodology in relation to the competences and course contents. Between 100 and 200 words)

The subject is taught basically using dynamic exposure session of concepts and solving exercises, problems and cases in a ratio of two to one. To promote the pursuit of the subject and its continuous assessment monitoring two controls mid- course and at the end of it you will be made. The series will solve the problems it faces; the resolution must present one in front of their peers.

ASSESSMENT

ASSESSMENT METHODS * (Complete the table relating assessment methods, competences, and weight percentage in the course qualification)

Assessment methods	Weight	Competences
Final Exam	50%	CB6, CB7, CE1, CE2, CE3, CE4
Continuous Assessment Activities	30%	CB6, CB7, CG1, CE1, CE2, CE3, CE4
Laboratory	10%	CB7, CG1, CE1, CE3, CE4
Participation	10%	CG1, CE1, CE4

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LEARNING OUTCOMES (Explanation of the student's achievements that allow the assessment of competences, relating them to the competences and the assessment methods)

The student will have acquired:
• Knowledge that give the base or opportunity to be original in the development and / or implementation of ideas.
• Ability to apply knowledge acquired.
• Ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study environments.
• Ability to design and carry out a project.
• Ability to apply their knowledge with critical thinking to establish economically viable solutions to technical problems.
• Ability to design processes, systems and services and related chemical industry.
• Ability to formulate engineering models, apply innovative methods in problem solving and appropriate for the design of processes and systems applications.

QUALIFICATION (Explanation of the qualification system)

The evaluation of the subject corresponds to 50 % final exam, 20% to controls, 10% to laboratory, 10% to problems and 10% to participation.

• The grading of the final exam has two parts:

Theory:		30 %
Problems:		70 %
	SUM	100 %

• The grading of the activities corresponds to:

Controls:		50 %
Exercises presented in class		25 %
Laboratory:		25%
	SUM	100 %

Test scores and activities are only valid if the student obtains at least:

1. A 4 in the final exam.
2. A 4 in the activities.

ASSESSMENT OF THE COMPETENCES (Describe the grading system for each competence in relation with the assessment tasks)

The evaluation of the competences is carried out through specific items of the different evaluation methods used.

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BIBLIOGRAPHY (Recommended and accessible to the student.)

- F. M. White, *Fluid Mechanics*. 6ª Ed. McGraw-Hill, 2008
- W.L. McCabe, J.C. Smith, P. Harriott, *Unit Operations of Chemical Engineering.* 7ª Ed. McGraw-Hill, 2005
- P.K. Kundu, I.M. Cohen, D.R. Dowling, *Fluid Mechanics.* 5ª Ed. Academic Press, 2012
- M. Potter, D.C. Wiggert, *Fluid Mechanics, Schaum's Outline.* 1ª Ed. McGraw-Hill, 2008
- P. Tipler. *Physics for Scientists and Engineers*. 6ª Ed. WH Freeman, 2007

DOCUMENT HISTORY

PREVIOUS REVISIONS (Indicate date and author / s, first the most recent one)
27/07/2015. Dr. Jordi Martorell

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06/03/2019. Dr. Jordi Martorell