



PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: UNIT OPERATIONS OF ENGINEERING I

SUBJECT MATTER: Fundamentals of Thermal and Fluids Engineering

MODULE: Core Topics of Industrial Engineering

PROGRAM: Degree in Chemical Engineering

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GENERAL FEATURES

Type: Basic Formation, Compulsory, Optional

Final Degree Project, Internship

Duration: Semestral

Semester: 4

Number of ECTS credits: 6

Language / s: Spanish, Catalan, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

Unit operations are the pieces that allow performing the various chemical processes in industry.

This course is dedicated to establishing the necessary basics for the development and application of methods and models of engineering of chemical and biological processes. Specifically, techniques of dimensional analysis and material balance, momentum transport (fluid mechanics) and equilibrium stages for calculating separation operations and their practical applications are presented.

COMPETENCES

- To be able to understand and apply the fundamental knowledge of dimensional analysis, fluid mechanics, material balances, and equilibrium stage modelling on which the most common chemical industry unit operations are based (CB1, E2).
- Be able to identify, formulate, and solve simple problems of dimensional analysis, fluid mechanics, material balances, and equilibrium stage modelling (CB2, E7).
- Knowledge of the basic principles of fluid mechanics and their application to problem solving in the field of engineering. Calculation of pipes, channels and fluid systems. (CRI2)

PREVIOUS REQUIREMENTS

According to the program planning and academic regulations.



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CONTENTS

1. Introduction to Chemical Engineering.
 - Chemical industry and Process Engineering
 - Units and dimensions.
 - Dimensional analysis.
2. Fluid Mechanics
 - Fluid statics and its applications.
 - Stirring and mixing.
 - Fundamental equations of fluid flow.
 - Non-compressible fluid flow in pipes.
 - Head loss
 - Centrifugal pumps
3. Mass transfer
 - Mass balances
 - Process, system and balance units.
 - Variables, equations and degrees of freedom.
 - Material balances without chemical reaction.
 - Material balances with chemical reaction.
 - Distillation.
 - Flash distillation.
 - Batch distillation
 - Continuous distillation with reflux.
 - McCabe-Thiele method.
 - Tray efficiency.

METHODOLOGY

LEARNING ACTIVITIES

Learning Activities	Hours	ECTS Credits	Competences
Lectures	30	1,2	CB1, E2, CRI2
Case and Problem-Solving Sessions	15	0,6	CB2, E7, CRI2
Personal Study	109	3,9	CB1, E2, CB2, E7, CRI2
Assessment Tasks (Exams, Continuous Assessment...)	8	0,3	CB1, E2, CB2, E7, CRI2
TOTAL	162	6	



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TEACHING METHODOLOGY

The teaching methods used in the course are based on a dynamic exposition (presentation of content) followed by an active dynamic (the student solves problems, some of which are discussed subsequently or corrected by the professor). The use of laptops that students have to solve problems and cases, whereby the active participation of students will be promoted, facilitating the acquisition of knowledge and practice in problem solving is encouraged. In addition, students will expose as a team work a case proposed by the professor.

For personal study, the course materials, collections of problems and supplementary materials through the learning management system IQS are provided. Students already have the necessary software.

ASSESSMENT

ASSESSMENT METHODS

Assessment methods	Weight	Competences
Final Exam	50%	CB1, E2, CB2, E7, CRI2
Continuous Assessment Activities	40%	CB1, E2, CB2, E7, CRI2
Participation	10%	CB1, E2

LEARNING OUTCOMES

- The student must demonstrate basic knowledge of dimensional analysis, fluid mechanics, material balances and equilibrium stage model on which the most common unit operations of the chemical industry are based (CB1, E2)
- The student must demonstrate proficiency in the identification, formulation and resolution of simple problems in the field of dimensional analysis, fluid mechanics, material balances and equilibrium stage models (CB2, E7)
- The student must demonstrate ability to solve problems in the field of engineering (CRI2).

QUALIFICATION

The evaluation of the subject corresponds 50% to the final exam, 30% to controls, 10% to problems and 10% to participation in the ordinary calls. In extraordinary calls only the final exam grade will be taken into account.

- The final exam grade consists of two parts:
 - Theory 35%
 - Problems 65%
- SUM 100%**



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- The qualification of the activities corresponds to:
 - Controls 75%
 - Exercises performed outside of class 25%
- SUM** **100%**

In order for the exam grades and activities to be valid in the ordinary session and to be able to pass the subject, a grade of 4.0 must be obtained in the final exam. In case of not fulfilling this condition, the grade of the final exam (3.9 or less) will be assigned as a final grade.

In subsequent calls, the final grade will be that of the examination in said call.

ASSESSMENT OF THE COMPETENCES

For the evaluation of the CB1 and E2 competences, the theory notes of the final exam and the activities and participation will be used.

For the evaluation of the competences CB2 and E7, the notes of problems of the final exam and of the activities will be used.

For the evaluation of the CRI2 competency, the final grade of the subject will be used.

BIBLIOGRAPHY

- W. L. McCabe, J. C. Smith y P. Harriott, *Operaciones unitarias en ingeniería química*, McGraw-Hill, 7ª ed., México 2007.
- J. F. Izquierdo, J. Costa, E. Martínez de la Ossa, J. Rodríguez y M. Izquierdo, *Introducción a la Ingeniería Química: problemas resueltos de balances de materia y energía*, Reverté, Barcelona 2011.
- F. White, *Mecánica de fluidos*, McGraw-Hill, McGraw-Hill, 6ª Ed., Madrid 2008.
- B. Munson, D. Young y T. Okiishi, *Fundamentos de Mecánica de Fluidos*, Limusa Wiley, 1ª ed., México, 1999.
- D. W. Green y R. H. Perry, *Chemical Engineers' Handbook*, 8ª ed., McGraw-Hill, New York 2008.



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DOCUMENT HISTORY

PREVIOUS REVISIONS

09/02/2016. Dr. Jordi Martorell

CURRENT REVISION

10/03/2019. Dr. Jordi Martorell