

SUBJECT TEACHING GUIDE

G1630 - Integration of chemical processes

Degree in Chemical Engineering First Degree in Chemical Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering First Degree in Chemical Engineering			Type and Year	Optional. Year 4 Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	SUBJECT OPTION C: GUIDANCE IN ADVANCED CHEMICAL ENGINEERING Optional Module				
Course unit title and code	G1630 - Integration of chemical processes				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR				
Name of lecturer	ANA MARIA URTIAGA MENDIA				
E-mail	ana.urtiaga@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 2. DESPACHO (S2065)				
Other lecturers	RAQUEL IBAÑEZ MENDIZABAL GABRIEL ZARCA LAGO				

3.1 LEARNING OUTCOMES

- To get knowledge on the design of processes integrated by several unit operations, with the aim of getting an optimized process and/or product. Case studies based on real innovation projects will focus at the design of clean/sustainable processes formed by several technologies: physical, chemical and biological, including reaction and separation operation. The miniprojects will deal with water reclamation for industrial reuse, the improvement of production conditions in marine aquaculture systems, and the conversion of CO₂ into green fuels and molecular synthesis blocks, all based in real case studies.

4. OBJECTIVES

To integrate the different unit operations comprised in a transformation process in the chemical industry . To design integrated processes to meet: i) resource efficiency; minimization of green house gases emissions; iii) minimization of waste generation; iv) increase of productivity; v) reduction of energy consumption; vi) zero emissions. Process innovation through case studies performed in collaboration with industrial partners.

6. SUBJECT PROGRAM

CONTENTS

1	Part I. Introduction. The need of process integration for increasing the competitiveness of production processes. Case study: Integration of chemical reaction and separation processes. Application to the production of reclaimed water for industrial reuse and zero-emission., using membrane based and electrochemical oxidation technologies.
2	Part II. Process integration in emerging production processes: biotechnology and food. Case study: Water recovery and energy optimization in marine aquaculture production through integration of advanced technologies.
3	Part III. Process integration for minimization of CO ₂ emissions and CO ₂ capture Case study. Membrane integration in catalytic heterogeneous reactors for CO ₂ capture and production of oxygenated hydrocarbons.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Individual mini-projects related to the case studies.	Work	No	Yes	50,00
Multiple choice / short question tests 1, 2 and 3	Others	No	Yes	50,00
TOTAL				100,00
Observations				
The continuous evaluation method will be used for the assessment of the course, in which the student's progress will be measured based on participation and performance in classroom activities, and assigned work (50%). In addition, three test-type questionnaires will be carried out at weeks 5, 10 and 15, in relation to the contents of each of the subjects (50%). In the final exam, students who fail the ongoing evaluation can recover unperformed tests. In the case of a health alert that makes it impossible to carry out the assessment in person, the evaluation methodologies may be adapted to the available telematics means				
Observations for part-time students				
In accordance with article 24 of the REGULATION OF the EVALUATION PROCESSES OF THE UNIVERSITY OF CANTABRIA, the specific procedures that guarantee in each case the evaluation of the same knowledge and competences to be acquired by students full-time will be established				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

- Membrane Technology in the Chemical Industry. Eds.: S.P. Nunes, K.V. Peinemann, Wiley, 2001.
- Sustainable design through process integration : fundamentals and applications to industrial pollution prevention, resource conservation, and profitability enhancement. Mahmoud M. El-Halwagi. 2nd ed. Elsevier, 2017.
- Chemical process design and integration. Robin Smith. Wiley, 2005.
- Artículos científico-técnicos de revistas electrónicas accesibles a través de la BUC

