

## SUBJECT TEACHING GUIDE

### G1780 - Analysis of Separation Processes

#### BILINGUAL UC-CU CIVIL ENGINEERING PROGRAM

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	BILINGUAL UC-CU CIVIL ENGINEERING PROGRAM			Type and Year	Optional. Year 1
Faculty	School of civil Engineering				
Discipline	Optional Subjects				
Course unit title and code	G1780 - Analysis of Separation Processes				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web					
Language of instruction	English	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR				
Name of lecturer	MANUEL ALVAREZ GUERRA				
E-mail	manuel.alvarezg@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 2. DESPACHO PROFESORADO (S2011)				
Other lecturers	INMACULADA ORTIZ URIBE JONATHAN ALBO SANCHEZ				

3.1 LEARNING OUTCOMES
- The acquisition of the fundamentals and applications of rate-controlled separation processes: membrane-based separation processes, as well as other advanced separation technologies (adsorption, ion-exchange).
- The acquisition of the fundamentals and applications of equilibrium-controlled separation processes: distillation, gas absorption/stripping, liquid-liquid extraction.
- The acquisition of the following transversal concepts and competences: continuous and batch processing, counter-current and co-current flow patterns, separation equipment, modeling of the performance of various separation systems, optimization of the design of separation systems to achieve targets for product purity, experience using modern computer software for designing separation processes and ability to develop and apply criteria for selecting among available separation technologies.

**4. OBJECTIVES**

- Be able to know the fundamentals and applications of rate-controlled separation processes: membrane-based separation processes, as well as other advanced separation technologies (adsorption, ion-exchange).
- Be able to know the fundamentals and applications of equilibrium-controlled separation processes: distillation, gas absorption/stripping, liquid-liquid extraction.
- Be able to understand and practice the following transversal concepts and competences: continuous and batch processing, counter-current and co-current flow patterns, separation equipment, modeling of the performance of various separation systems, optimization of the design of separation systems to achieve targets for product purity, experience using modern computer software for designing separation processes and ability to develop and apply criteria for selecting among available separation technologies.

**6. SUBJECT PROGRAM**

CONTENTS

1	1. Introduction to separation processes 1.1. Introduction 1.2. Overview, definitions and classification of separation processes
2	2. Case studies of environmental and industrial applications 2.1. Energy sector: CO <sub>2</sub> capture from flue gases 2.2. Water treatment: Tertiary wastewater treatment 2.3. Food industry: Dairy products processing 2.4. Pharmaceutical industry: Purification of active ingredients and solvent recovery
3	3. Rate-controlled separation processes 3.1. Introduction: definitions and classification 3.2. Experimental case study: design of a suitable wastewater reclamation process, including as available technologies pressure-driven membrane processes (microfiltration, ultrafiltration, nanofiltration, reverse osmosis) and other advanced separation processes (adsorption, ion-exchange)
4	4. Equilibrium-controlled separation processes 4.1. Introduction: definitions and classification 4.2. Tray-column technology 4.3. Pack-column technology 4.4. Gas absorption/stripping 4.5. Binary distillation 4.6. Multi-component distillation 4.7. Liquid-liquid extraction 4.8. Other (bio)separation processes

### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Partial exam 1	Written exam	No	Yes	22,50
Portfolio 1	Others	No	Yes	5,00
Presentation experimental sessions 1	Oral Exam	No	Yes	22,50
Partial exam 2	Written exam	No	Yes	30,00
Portfolio 2	Others	No	Yes	10,00
Presentation practical sessions 2	Oral Exam	No	Yes	10,00
<b>TOTAL</b>				<b>100,00</b>
<b>Observations</b>				
The student who does not follow the continuous evaluation procedure will have the option of performing a final exam on the date scheduled by the School (minimum mark 5.0)				
<b>Observations for part-time students</b>				
Due to the particular characteristics of this Program, this section does not apply				

### 8. BIBLIOGRAPHY AND TEACHING MATERIALS

#### BASIC

- Seader J.D., Henley E.J., Roper D.K., Separation Process Principles (4th ed.), 2016, John Wiley & Sons, Inc.
- Wankat, P.C. Separation Process Engineering: Includes Mass Transfer Analysis, Third Edition, 2012, Pearson Education.
- Wankat, P.C., Rate-Controlled Separations, 1996, Blackie Academic & Professional.