# SUBJECT TEACHING GUIDE

## G1629 - Advanced separation technologies

## Degree in Chemical Engineering

Academic year 2016-2017

| 1. IDENTIFYING DATA | | | | | |
|---|---|---|---|---|---|
| Degree | Degree in Chemical Engineering | | | Type and Year | Optional. Year 4 |
| Faculty | School of Industrial Engineering and Telecommunications | | | | |
| Discipline | SUBJECT OPTION C: GUIDANCE IN ADVANCED CHEMICAL ENGINEERING<br>Optional Module | | | | |
| Course unit title and code | G1629 - Advanced separation technologies | | | | |
| Number of ECTS credits allocated | 6 | Term | Semester based (1) | | |
| Web | | | | | |
| Language of instruction | Spanish | English Friendly | No | Mode of delivery | Face-to-face |

| | |
|---|---|
| Department | DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR |
| Name of lecturer | EUGENIO BRINGAS ELIZALDE |
| E-mail | eugenio.bringas@unican.es |
| Office | E.T.S.I. Industriales y Telecomunicación. Planta: - 2. DESPACHO (S2013) |
| Other lecturers | MARIA FRESNEDO SAN ROMAN SAN EMETERIO<br>PEDRO MANUEL GOMEZ RODRIGUEZ |

## 3.1 LEARNING OUTCOMES

- Be able to know the fundamentals and applications of rate-controlled separation processes:
  - Membrane-based separation processes
  - Solid-fluid separation processes

## 4. OBJECTIVES

Be able to know and understand from a qualitative and quantitative point of view the phenomena taking place in membrane units and adsorption/ion exchange columns.
Be able to identify and compare advanced separation processes on their application in solving separation problems in the context of industry and environment

## 6. COURSE ORGANIZATION

| CONTENTS | |
|---|---|
| 1 | 1. UNIT 1: Introduction to advanced separation processes<br>1.1. Introduction<br>1.2. Definition and classification of advanced separation processes<br>1.3. Examples of environmental and industrial applications |
| 2 | 2. UNIT 2. Membrane-based separation processes<br><br>2.1. Pressure driven membrane processes: microfiltration (MF), ultrafiltration (UF), reverse osmosis (RO) and nanofiltration (NF). Fundamentals, design and applications.<br><br>2.2. Concentration gradient driven membrane processes: pervaporation, gas permeation, dialysis, membrane-based solvent extraction. Fundamentals, design and applications.<br><br>2.3. Other membrane-based separation processes: electrodialysis, forward osmosis and pressure retarded osmosis. |
| 3 | 3. UNIT 3. Fluid-solid separation processes<br><br>3.1. Adsorption. Fundamentals, design and applications.<br><br>3.2. Ion Exchange. Fundamentals, design and applications. |

## 7. ASSESSMENT METHODS AND CRITERIA

| Description | Type | Final Eval. | Reassessn | % |
|---|---|---|---|---|
| Partial Exam | Written exam | No | Yes | 50,00 |
| Prersentation of practical sessions | Oral Exam | No | Yes | 50,00 |
| TOTAL | | | | 100,00 |

**Observations**

Continuous assessment procedure is based on the execution of tests 1 (25%) and 2 (25%) to evaluate the theoretical contents, a power point presentation to evaluate the practical sessions (50%).
The student who do not follow the continuous evaluation procedure will have the option of performing a final exam in the date scheduled by the ETSIIyT (minimum mark 5.0)

**Observations for part-time students**

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

WANKAT, P.C., Rate-Controlled Separations, 1996, Blackie Academic & Professional.
- SEADER, J.D., HENLEY, E.J. Separation Process Principles. 2006. 2nd Wiley & Sons.
- CUSSLER, E.L., Diffusion. Mass Transfer in Fluid Systems. 2009. 3rd Ed. Cambridge University Press.
- DRIOLI, E., CRISCUOLI, A., CURCIO, E., Membrane Contactors: Fundamentals, Applications and Potentialities. 2006. Elsevier.
- COULSON, J.M. RICHARDSON, J.F. Chemical Engineering (Particle Technology and Separation Processes). 2002. Oxford; Butterworth Heinemann, 2002