

## 29925 - Separation Operations

### Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	435 - Bachelor's Degree in Chemical Engineering
ECTS	6.0
Course	3
Period	Half-yearly
Subject Type	Compulsory
Module	---

### 1.Basic info

#### 1.1.Recommendations to take this course

#### 1.2.Activities and key dates for the course

### 2.Initiation

#### 2.1.Learning outcomes that define the subject

#### 2.2.Introduction

### 3.Context and competences

#### 3.1.Goals

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#### 3.2.Context and meaning of the subject in the degree

#### 3.3.Competences

#### 3.4.Importance of learning outcomes

### 4.Evaluation

### 5.Activities and resources

#### 5.1.General methodological presentation

**The learning process that is designed for this course is based on the following:**

The learning process will take place at several levels: lectures, problem solving classes and tutoring works, increasing the level of student participation. In the lectures, the theoretical bases and some model problems are presented. The problem solving classes are the effective complement of lectures to verify the comprehension of matter and help to develop in

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students a more engineering view, the students will solve the problems proposed by the teacher with some guidelines. Finally, tutoring works will be a complement.

### 5.2.Learning activities

The program to achieve the expected results includes the following activities:

**Lectures** (40 h) where the theory of the various subjects that have been proposed will be presented and also model problems will be solved on the blackboard.

**Problem solving classes** (20 h). Exercises supervised by the professor will be solved by the students. Problems will be related to the theoretical part explained in lectures.

**Tutoring works** in groups (27 hours). Groups of three components will be formed and along the semester five activities will be proposed to be supervised by the teachers. Deliverables will be corrected and evaluated, so there is a feedback to the student.

**Individual study** (60 hours). It is strongly recommended that students perform individual study continuously along the semester,

**Final Evaluation** (3 h). A global test will be performed where the theoretical and practical knowledge acquired by the student will be evaluated.

### 5.3.Program

The program has next topics:

1. Introduction to Separation Processes
2. Contact between phases
3. Distillation
4. Absorption
5. Liquid-liquid extraction
6. Leaching
7. Adsorption
8. Membrane processes

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### 5.4.Planning and scheduling

Lectures and solving problems classes are given according to schedule established by EINA. Each teacher informs about schedule for tutoring.

Groups of 3 peoples will solve four problems or practical cases proposed by the teacher. In addition to these four problems, each group will propose and solve a problem that will be corrected by another group. These activities will involve a total of 5 deliverables, distributed throughout the semester.

The following table shows an approximate schedule of topics in terms of hours of lectures and problem solving classes. It also indicates approximately when students would be proposed the deliverables and the time that must be dedicated to these activities and their personal work. It indicated when approximately tutored sessions should take place.

Topic	Lectures + Problem solving classes	Deliverables (Del.) and Tutoring (T)	Individual study
1. Introduction	2 h + 0 h		2 h
2. Contact between phases	6 h + 3 h	Del. 1 (4 h), T1	9 h
3. Distillation	12 h + 6 h	Del. 2 (11 h), T2	18 h
4. Absorption	5 h + 3 h		8 h
5. Liquid-liquid extraction	5 h + 3 h	Del. 3 (4 h)	8 h
6. Leaching	4 h + 3 h	Del. 4 (4 h), T3	7 h
7. Adsorption	3 h + 1 h		4 h
8. Membrane processes	3 h + 1 h	Del. 5 (4 h), T4	4 h
<b>Total</b>	40 h + 20 h	27 h	60 h

### 5.5.Bibliography and recommended resources

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- BB** McCabe, Warren L.. Operaciones unitarias en ingeniería química / Warren L. McCabe, Julian C. Smith, Peter Harriott ; revisor técnico René Huerta Cevallos ; [traductor, Alejandro Carlos Piombo Herrera] . - 7ª ed. México D. F. : McGraw-Hill Interamericana, cop. 2007
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- BB** Treybal, Robert E.. Operaciones de transferencia de masa / Robert E. Treybal ; traducción Amelia García Rodríguez, revisión técnica Francisco José Lozano . - 2a ed. [reimp.] México [etc] : McGraw-Hill, 1994
- BC** Benítez, Jaime. Principles and modern applications of mass transfer operations / Jaime Benítez New York : Wiley-Interscience, cop. 2002
- BC** Henley, Ernest J.. Operaciones de separación por etapas de equilibrio en ingeniería química / Ernest J. Henley, J.D. Seader ; [versión española por Fidel Mato Vázquez y Rafael Bartolomé Mato Chaín] . - [1ª ed., reimpr.] México : Reverté Ediciones, cop. 2000 (reimpr.)
- BC** Martínez de la Cuesta, Pedro José. Operaciones de separación en ingeniería química : métodos de cálculo / Pedro J. Martínez de la Cuesta, Eloísa Rus Martínez Madrid [etc.] : Pearson Prentice Hall, D. L. 2004
- BC** Seader, J. D.. Separation process principles / J. D. Seader, Ernest J. Henley . - 2nd ed. Hoboken, NJ : John Wiley & Sons, cop. 2006