

# Separation Processes II

**Calendar:** 5<sup>th</sup> day semester

**Contact Hours:** T 30,0h; PL 22,5h; OT 7,5h

**Scientific Area:** Processes in Chemical and Biological Engineering

## **Learning outcomes of the curricular unit:**

It is intended that the student learns the main unit operations involving heat transfer and mass transfer of global and partial balances applied to the design of industrial equipment. The unit operations lectured are: distillation; gas absorption; liquid-liquid extraction. The goal is to supply the student with the tools for the design of equipment used in the studied unit operations and choose the most suitable for different applications. The students must obtain the following competencies: Identify the basic principles governing the different separation processes; choose processes more appropriate for a given separation; scale certain separation equipment and evaluate the influence of operating conditions on the final separation.

## **Syllabus:**

Chapter 1 - 5.5 weeks

Distillation

Principles. Flash Distillation. Continuous and batch distillation.

Distillation equipment: sieve columns and packed columns.

Chapter 2 - 3.5 weeks

Gas absorption

Concepts. Criteria for choosing the absorbent and types. Industrial equipment.

General considerations for the project. Design of packed columns.

Overall project Equation - strong absorption.

Chapter 3 - 4.0 weeks

## Liquid-Liquid Extraction

Three phase systems. Ternary diagrams. Extraction of immiscible liquids. Liquid-Liquid Extraction for partially miscible systems

### **Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:**

The curricular unit of Separation II aims to supply students with the knowledge of separation processes used extensively by the refining industry, particularly in the separation of compounds by distillation, in packed columns (for gases) and liquid-liquid extraction. At the same time it is intended that students acquire the knowledge to analyze and size the separation equipment. The importance of these processes in the industry is very significant, for this reason it was decided to only consider these in the syllabus of this UC in order to lecture these processes in a more comprehensive and deeper manner. Consequently, this UC is divided into only three chapters, each corresponding to a separation process.

### **References:**

1. Coulson, J.M. and Richardson, J.F., "Chemical Engineering", Vol. III, Pergamon Press, (1985)
2. Ladisch, M. R., "Bioseparations Engineering: Principles, Practice, and Economics", John Wiley & Sons, (2001)
3. Seader, J. D. e Henley, E.J., "Separation Processes Principles", John Wiley & Sons, New York (1998)