

## 60644 - Equipment for Chemical Processes

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 60644 - Equipment for Chemical Processes

**Faculty / School:** 100 -

**Degree:** 540 - Master's in Industrial Chemistry

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester

**Subject Type:** Compulsory

**Module:** ---

### 1.General information

#### 1.1.Aims of the course

#### 1.2.Context and importance of this course in the degree

#### 1.3.Recommendations to take this course

### 2.Learning goals

#### 2.1.Competences

#### 2.2.Learning goals

#### 2.3.Importance of learning goals

### 3.Assessment (1st and 2nd call)

#### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

### 4.Methodology, learning tasks, syllabus and resources

#### 4.1.Methodological overview

This course includes 6 ECTS, 4 ECTS devoted to lectures on theory and examples, and 2 ECTS to the solution of problems given as homework.

The expected 150 hours of work by the students are distributed as follows:

- 40 hours of lectures on theory and problems.
- 20 hours for the explanation and class discussion of the examples previously proposed for homework.
- 85 hours of autonomous work.
- 5 hours of assessment, corresponding to a written final exam.

#### 4.2.Learning tasks

Lectures on theory and problems will be scheduled according to the timetable given by the Faculty of Sciences. Additionally, each professor will inform of their office hours.

#### 4.3.Syllabus

The course will address the following topics:

1. Mass and energy balances: General conservation principles. Macroscopic balances in continuous contact processes with equilibrium stages. Microscopic balances in continuous differential contact. Transport coefficients
2. Chemical Reactors: Homogeneous reactors. Complex Reactions: series, parallel and series-parallel. Reactor optimization. Heterogeneous gas-solid catalytic and non-catalytic. Effectiveness factor and Thiele modulus. Fixed and fluidized bed reactors. Biochemical Reactors.
3. Separation unit operations: Material Separation Agent and Energy Separation Agent. Advantages and disadvantages. Examples. Rectification of binary mixtures. Design of rectification towers by the McCabe-Thiele method. Effectiveness factor. Liquid-Liquid extraction. Fundamentals and calculations methods.
4. Heat transfer equipment: Heat transfer in fluids with and without phase change. Empirical correlations. Shell-tubes heat exchangers. Multiple passes. Single effect and multiple effect evaporators.
5. Flow of fluids: Bernoulli equation. Fluid of non-compressible fluids in tubes. Friction factor and pressure drop. Transport of fluids: tubes, valves, pumps and compressors.
6. Auxiliary services: heating and refrigeration, water, compressed air and electricity.

#### **4.4.Course planning and calendar**

This course is given in the first semester (September-February).

The place and timetable for lectures will be established at the beginning of the course and published on the website of the Faculty of Science

<http://ciencias.unizar.es/> .

#### **4.5.Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=60644&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=60644&year=2019)