



PERSONA CIÈNCIA EMPRESA  
UNIVERSITAT RAMON LLULL

## COURSE: REACTOR DESIGN

**SUBJECT MATTER:** Chemical Transformations Engineering

**MODULE:** Specific Technology

**PROGRAM:** Degree in Chemical Engineering

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### GENERAL CHARACTERISTICS

**Type:**  Basic Formation,  Compulsory,  Elective

Final Degree Project,  Internship

**Duration:** Semestral

**Semester/s:** 7

**Number of ECTS credits:** 5

**Language/s:** Spanish, Catalan, English

### DESCRIPTION

#### SHORT DESCRIPTION AND JUSTIFICATION

Classification and presentation of the most common types of reactors. Selection criteria. Design of ideal reactors, Batch, PFR and CSTR. Reactors in series. Consideration of the non-ideality in the flow in reactors. Design of reactors for heterogeneous reactions. Design of reactors for biological / biochemical reactions

#### COMPETENCES

- To be able to understand and apply knowledge of Chemistry and Engineering for its application in the field of Chemical Engineering. (CB1, E2)
- Be able to identify, formulate and solve problems in the fields of Chemical Engineering and Chemistry. (CB2, E7)
- E8 - Be able to analyze, integrate and interpret data and information from the field of Chemical Engineering. (CB3, E8)
- Be able to assess the impact of their professional activity on the sustainable development of society. (T3)
- Knowledge of material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, reactor design, and valorization and transformation of raw materials and energy resources. (TE1)

#### PREREQUISITES

According to current academic teaching planning and regulations.



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### CONTENTS

1. Introduction. Preliminary considerations.
2. Fundamental concepts
3. Batch reactor (BR).
4. Continuous Stirred Tank Reactor (CSTR).
5. Tubular Reactors (PFR y PBR)
6. Bioreactors
7. Residence time distribution and mixing in reactors

### METHODOLOGY

### LEARNING ACTIVITIES

Learning activities	Hours	ECTS Credits	Competences
Lectures	33	1.2	CB1, E2, CB3, E8, T3, TE1
Case and Problem-Solving Sessions	11	0.4	CB1, E2, CB2, E7, CB3, E8, TE1
Seminars			
Practical & Lab Work			
Presentations			
Personal study	86	3,2	CB1, E2, CB2, E7, CB3, E8, T3, TE1
Assessment Tasks (Exams, Continuous Assessment...)	5	0,2	CB1, E2, CB2, E7, CB3, E8, T3, TE1
<b>TOTAL</b>	<b>135</b>	<b>5,0</b>	

### TEACHING METHODOLOGY

This subject will use the following teaching methodologies:

- The didactic methodology is based on sessions of exposition of concepts in which the fundamental contents of the subject are presented to the student.
- Resolution of exercises, approach / resolution of problems and exposure / discussion of cases by a professor with the active participation of students.



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- Instruction carried out by a professor with the objective of reviewing, discussing and resolving doubts about the materials and topics presented in the concepts presentation sessions and in the resolution sessions of exercises, problems and cases.
- Student's personal work to acquire the competences of each subject.
- Written tests to evaluate the competences acquired.

### ASSESSMENT

#### ASSESSMENT METHODS

Assessment Methods	Weight	Competences
Final Exam	40%	CB1, E2, CB2, E7, CB3, E8, TE1
Midterm Exam/s	--	--
Follow-up Activities	35%	CB1, E2, CB3, E8, TE1
Reports and Presentations	20%	CB1, E2, CB2, E7, CB3, E8, T3, TE1
Lab or Field Work	--	--
Projects	--	--
Host Student Evaluation	--	--
Participation	5%	T3, TE1

#### LEARNING OUTCOMES

The students will have acquired:

- The capacity to demonstrate that they possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study. (CB1, E2, TE1)
- The capacity to know how to apply their knowledge to their work or vocation in a professional manner and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study. (CB2, E7, TE1)
- The capacity to collect and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues. (CB3, E8, TE1)
- The capacity to assess the impact of their professional activity on the sustainable development of society. (T3, TE1)



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### **QUALIFICATION**

The final grade of the course will consider the grades obtained by the student in the final exam (EF), Follow-up activities (AS), Reports and presentations (TP) and participation (P).

The EF final exam will consist of two parts: 30% knowledge assessment and 70% problem solving.

The AS follow-up activities will consist of partial rapid response controls, where theoretical knowledge will be evaluated and analysis/resolution of small calculations will take place in the scheduled timetable and classroom for the teaching of the subject. The AS qualification will be the arithmetic average of all those carried out.

Reports and Presentations TP will be evaluated through the qualification of exercises and problems in writing carried out by the student individually.

Participation P will be evaluated by controlling the student's attendance at the scheduled hours of the subject and participation in class.

The final grade of the course in all official calls of the subject will be calculated:  
 $0.40 \text{ EF} + 0.35 \text{ AS} + 0.2 \text{ TP} + 0.05 \text{ P}$ .

### **ASSESSMENT OF THE COMPETENCES**

The evaluation of competences is obtained:

- CB1/E2: corresponds to the qualification of the section of knowledge obtained in the final examination and follow-up activities.
- CB2/E7: corresponds to the weighted average score of the problem solving section of the final exam and reports.
- CB3/E8: corresponds to the weighted average score of the problem solving section of the final exam.
- T3: corresponds to the qualification of the Reports and Participation activity.
- TE1: corresponds to the final grade of the course.



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- M.L. Shuler and F. Kargi, "Bioprocess Engineering: Basic Concepts", 2nd ed., Prentice-Hall (2002).

### **DOCUMENT HISTORY**

#### **PREVIOUS REVISIONS**

September 2016. Eduard Serra Hosta

February 2015. Xavier Turon Casalprim

#### **CURRENT REVISION**

September 2018. Eduard Serra Hosta