Course guide
320070 - EPQB - Chemical and Biotechnological Process Engineering

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
Degree: BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan

LECTURER

Coordinating lecturer: Fernando Carrillo Navarrete

Prior Skills

It is recommended that students have passed the objectives of the courses: Unit Operations, Chemical Reaction Engineering and Chemical Process Control.
It is also recommended that students have previously achieved a level of basic knowledge in chemical process simulation, similar to the course of Chemical Process Control.
It is also important that the student has achieved the objectives of the second level of transversal competences: independent learning, effective oral and written communication and teamwork.

Degree Competences to Which the Subject Contributes

Specific:
5. CHE: Knowledge of material and energy balances, biotechnology, the transfer of materials, separation operations, chemical reaction engineering, the design of reactors, and the reuse and transformation of raw materials and energy resources.
4. CHE: ability to analyse, design, simulate and optimise processes and products.
TEACHING METHODOLOGY

Communication with students for the dissemination of information is carried out through the Virtual Campus of the UPC, which is currently at the service of professors and students.

Didactic material is provided to the student (digital presentations, list of activities, instructions and delivery preparation templates) to facilitate their follow-up.

The subject has been planned so that the student works autonomously third level transversal skills: autonomous learning, effective oral and written communication and teamwork.

In order for the student to achieve the objectives and the programmed competences, the subject is structured in three types of sessions:

- Theoretical sessions (30 h): the professor explains the theoretical basis of the material, concepts, and methods and illustrates them with examples to facilitate understanding.

- Application Sessions (15h): The professor will guide students in applying theoretical concepts to solve chemical process engineering problems.

- Cooperative learning based on a Plant Design Project: Analysis, Sinthesis and preliminary design of a chemical process, prioritizing teamwork.
  Work will be performed in cooperation with other teams to get a proper process design. The assessment of the design project is made through the delivery of written and oral individual and team activities.

- Homework (90): The students have to dedicate time to develop the course activities programmed.

- Exams (6h): 2 exams have been planned.

The students will receive feedback assessments of their learning progress from teacher in order that, if necessary, the student can reorient their work.

LEARNING OBJECTIVES OF THE SUBJECT

Applying chemical engineering principles to the analysis and design of chemical processes and industrial biotechnology that aims the processing of raw materials and energy resources in desired products.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## CONTENTS

### Topic 1. The design and engineering processes

**Description:**
1.1 Introduction  
1.2 Nature Design  
1.3 The design process  
1.4 Engineering Project  
- Organization of a chemical engineering project  
- Design Bases  
- Codes and Standards  
- Design Factors  
- Project Documentation  
1.5 Ethical Considerations  
1.6 Activities

**Full-or-part-time:** 4h  
Practical classes: 2h  
Self study: 2h

### Topic 2. Preliminary Synthesis of Chemical Processes

**Description:**
2.1 Introduction  
2.2 Process Creation  
- Design and process definition  
- Evaluation and selection of alternatives  
- Preliminary Synthesis: tree alternatives.  
2.3 Heuristics for Process Synthesis  
2.4 Activities

**Full-or-part-time:** 12h  
Practical classes: 6h  
Self study: 6h

### Topic 3. Flowcharts and process integration

**Description:**
3.1 Flowchart overview.  
3.2 Integration of basic operations.  
3.3 Integration of processes: heat exchange networks.  
3.4 The P & I diagram

**Full-or-part-time:** 24h  
Practical classes: 12h  
Self study: 12h
### Topic 4. Health, Safety and Environment

**Description:**
- 4.1 Introduction
- Safety Legislation
- The layered pyramid plant safety
- 4.2 Dangers of hazardous materials and processes
- 4.3. HAZOP
- Examples of accidents
- 4.3 Security analysis
- Safety Indices
- Hazard and operability studies
- 4.4 Environmental Considerations

**Full-or-part-time:** 12h
Practical classes: 6h
Self study : 6h

### Topic 5. Economic Analysis

**Description:**
- 5.1 Estimated capital investment
- 5.2 Estimated manufacturing cost
- 5.3 Profitability Analysis
- 5.4 Economic optimization

**Full-or-part-time:** 8h
Practical classes: 4h
Self study : 4h

### Tema 7. Examples of relevant industrial processes

**Description:**
- 7.2. Production of base chemicals.
- 7.3. Production of bulk chemicals.
- 7.4. Polimerization processes.
- 7.5. Biotechnological processes.

**Full-or-part-time:** 90h
Theory classes: 30h
Self study : 30h
Self study : 30h
GRADING SYSTEM

- 1st Exam: 25%
- 2nd Exam: 25%
- Deliverables: 25%
- Design Project: 25%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

BIBLIOGRAPHY

Basic:

Complementary: