Degree competences to which the subject contributes

Specific:
1. Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, critical reasoning to establish economically viable solutions to technical problems.

2. Conceptualize engineering models; apply innovative methods in problem solving and applications suitable for the design, simulation, optimization and control of processes and systems.
3. Designing products, processes, systems and services for the chemical industry as well as the optimization of other already developed technology based on various areas of chemical engineering, understanding of processes and transport phenomena, separation operations and engineering chemical reactions, nuclear, electrochemical and biochemical.
4. Easily integrate technical team and creative interdisciplinary any chemical company or research center.

General:
5. Ability to apply the scientific method and the principles of engineering and economics, to formulate and solve complex problems in processes, equipment, facilities and services, in which the material changes its composition, state or energy content, characteristic of chemical industry and other related sectors which include the pharmaceutical, biotechnology, materials, energy, food or environmental.
6. Communicate and discuss proposals and conclusions in forums multilingual, skilled and unskilled, in a clear and unambiguous.
7. Ability to analyze and synthesize to the continued progress of products, processes, systems and services using criteria of safety, affordability, quality and environmental management.

Teaching methodology

MD.1. Apprenticeship contract; MD.2. Lectures; MD.5. Project-based learning, problems and cases.

Learning objectives of the subject

1. To gain an understanding on the chemical structure of polymers and biopolymers, their classification and nomenclature.
2. To acquire knowledge about the basic properties of polymers and biopolymers and how they relate to chemical and physical structure.
3. To acquire acknowledge about the chemical processes involved in the production of synthetic polymers and the recovery of biopolymers.
4. To acquire a general knowledge about commercial polymeric materials, their properties and applications.
5. To acquire a knowledge on advanced polymeric materials and research strategies for their technical development.
6. To acquire an understanding of the main biopolymers with technical applications.
7. To acquire knowledge about the ecological impact of the use of plastic materials and technologies used to minimize environmental impact.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 36h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 18h</td>
<td>12.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 96h</td>
<td>64.00%</td>
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</tbody>
</table>
### 1. Polymer chemistry

**Learning time:** 24h  
- Laboratory classes: 3h  
- Other activities: 12h  
- Theory classes: 6h  
- Practical classes: 3h

**Description:**

**Related activities:**
Resolution of a collection of exercises that allows students to become familiar with the structure and nomenclature of polymers as well as the basic techniques of chemical characterization (GPC chromatography, IR spectroscopy and NMR spectroscopy). To perform a laboratory practice of characterization and polymerization and the corresponding report.

**Specific objectives:**
Know and understand the chemical structure of polymers, how it is determined and how it relates to the behavior of polymers. To have a basic understanding of the procedure used for the synthesis of polymers and how they apply to an industrial level, Knowing the degradation processes that affect the use of polymers and the exploitation and reuse.

### 2. Polymer physics

**Learning time:** 30h  
- Other activities: 15h  
- Theory classes: 9h  
- Practical classes: 4h 30m  
- Laboratory classes: 1h 30m

**Description:**

**Related activities:**
Solve a set of problems which include thermodynamic facts of solutions, physicochemical characterization, structural analysis and solid state properties. To perform a laboratory practice and the corresponding report.

**Specific objectives:**
Understand the physicochemical principles of the behavior of polymer solutions and apply them in the characterization of polymeric materials. To have a basic knowledge about the structure of the polymers and its influence on physical properties.
3- Biopolymers

<table>
<thead>
<tr>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other activities: 9h 30m</td>
</tr>
<tr>
<td>Theory classes: 9h</td>
</tr>
<tr>
<td>Practical classes: 1h 30m</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
Individual work on the production, properties and applications of a biopolymer or a biopolymer derivative that will be chosen by each student.

**Specific objectives:**
The sources and applications of biopolymers of technological interest, their use and their potential as competitive materials respect to petrochemical-based plastics.

4. Commodity materials

<table>
<thead>
<tr>
<th>Learning time: 14h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h 30m</td>
</tr>
<tr>
<td>Practical classes: 1h 30m</td>
</tr>
<tr>
<td>Guided activities: 8h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
Individual work on the production, properties and applications of a determined polymer to be chosen by each student.

**Specific objectives:**
To have a knowledgement of the properties and applications of synthetic polymers more frequently used.
### 5. Technology and processing of polymers

**Learning time:** 9h  
Other activities: 4h 30m  
Theory classes: 3h  
Practical classes: 1h 30m

**Description:**

**Related activities:**
Individual work explaining the ways of processing a given polymer that will be selected by each student. To perform a laboratory practice and the corresponding report.

**Specific objectives:**
Have a knowledgement of additives and formulation of polymeric materials. Know the main technologies used in processing different types of polymeric materials.

### 6. Development of new materials

**Learning time:** 14h  
Self study (distance learning): 8h  
Theory classes: 4h 30m  
Laboratory classes: 1h 30m

**Description:**

**Related activities:**
Discussion of two scientific papers to be selected according to a specific subject.

**Specific objectives:**
Know the progress in the design of new polymeric materials of interest in industry and in the field of both theoretical and applied research.

### Qualification system

IE.1. Written exam; IE.3. Issues, test, problems, mini reports.

### Regulations for carrying out activities

There will be two exams during the course each one representing 25% of the overall rating, reports and solution of proposed problems will be up to 30% and the realization of thematic works the 20%. Qualification of the reevaluation probe will correspond to the 100% of the overall rating.
Bibliography

Basic:

Complementary: