Biotechnological processes can be applied to the production of a large variety of compounds, ranging from bulk chemicals to pharmaceutical products and monoclonal antibodies. The production of biotechnological products and drugs is currently an industrial standard. The aim of the course is to present these processes, their operation, and the tools that allow to design and produce new compounds. The subject is divided into two sections: the first one includes concepts of biochemical synthesis and biocatalysis and the study of the enzymes and their reactions. In this first section, significant examples will be developed to obtain products of industrial interest. In the second section, emphasis will be placed on the production of biocatalysts and proteins and other biotechnological products such as vaccines, vitamins and antibodies.

**COMPETENCES** (of the course placed in relation to the pre-assigned competences in the subject matter)

- That students develop those learning skills necessary to undertake further studies with a high degree of autonomy. (CB5)
- Be able to assess the impact of their professional activity on the sustainable development of society. (T3)
- Be able to incorporate contemporary aspects related to the exercise of their profession. (T5)
- Be able to understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology. (E3)
- Be able to integrate the knowledge and tools of biotechnology for their application to different industrial sectors that use, develop or produce biotechnological products or processes. (E6)

**PREVIOUS REQUIREMENTS** * (modules, subject matters, courses or knowledge necessary for the follow-up of the subject. State previous courses required to be completed)


* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).
From third year of Degree in Biotechnology: Protein Engineering, Therapeutic Targets and Pharmacology, Genomics, Proteomics and Metabolomics.

CONTENTS  (List the content of the course, with up to two level detail)

Section I (Dr Ciril Jimeno)

1. Biocatalysis. Chirality in nature.
3. Classification of enzymes and enzymatic reactions. Basic mechanisms.
4. Production of bulk chemicals.
5. Fine chemicals and agrochemical products.
6. Production of pharmaceutical products.
7. Production of food additives.

Section II (Dr Teresa Pellicer)

8. Industrial production of biocatalysts and therapeutic proteins.
9. Vaccines.
10. Monoclonal antibodies.
12. Vitamins.

METHODODOLOGY

LEARNING ACTIVITIES  *  (Complete the table relating activities, workload in ECTS credits, and competences.)

<table>
<thead>
<tr>
<th>Learning Activities</th>
<th>ECTS Credits</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>1,3</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Case and Problem-Solving Sessions</td>
<td>0,1</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Seminars</td>
<td>0,1</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Practical and Lab Work</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Presentations</td>
<td>0,1</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Personal Study</td>
<td>3,3</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Assessment Tasks (Exams, Continuous Assessment...)</td>
<td>0,1</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5,0</strong></td>
<td><strong>B5, T3, T5, E3, E6</strong></td>
</tr>
</tbody>
</table>

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TEACHING METHODOLOGY (justify the teaching methodology in relation to the competences and course contents. Between 100 and 200 words)

The teaching methodology is based on the following learning activities:

- **Lectures** - Presentation and explanation of contents by a teacher (possibly including demonstrations).
- **Case and Problem-Solving Sessions** - Resolution of exercises and problems, and exposition / discussion of cases by a teacher with the active participation of students.
- **Seminars** - Period of instruction carried out by a teacher with the aim of reviewing, discussing and resolving doubts about the materials and topics presented in the lectures and in the case and problem-solving sessions.
- **Presentations** - Oral presentation by a student to a teacher and/or other students. The presentation can be a work prepared by the student through searches in published bibliography, or a summary of a practical work or a project.
- **Personal study activities** - Personal work of the student necessary to acquire the competences of each subject matter, and to assimilate the knowledge exposed in lectures and case and problem-solving sessions, using the recommended reference materials. They also include the preparation of tasks related to the other activities, and the preparation of exams.
- **Assessment Tasks** - Oral and / or written tests made during the academic period of a course, or once it has finished (final exams, follow-up controls).

ASSESSMENT

ASSESSMENT METHODS * (Complete the table relating assessment methods, competences, and weight percentage in the course qualification)

<table>
<thead>
<tr>
<th>Assessment methods</th>
<th>Weight</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Exam</td>
<td>50%</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Midterm Exam/s</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Continuous Assessment Activities</td>
<td>10%</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Reports and Presentations</td>
<td>30%</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
<tr>
<td>Lab or Field Work</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Projects</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Host Student Evaluation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Participation</td>
<td>10%</td>
<td>B5, T3, T5, E3, E6</td>
</tr>
</tbody>
</table>

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**LEARNING OUTCOMES** (Explanation of the student's achievements that allow the assessment of competences, relating them to the competences and the assessment methods)

- Students need to develop those learning skills necessary to undertake further studies with a high degree of autonomy (B5).
- Students need to assess the impact of their professional activity on the sustainable development of society (T3).
- Students need to incorporate contemporary aspects related to the exercise of their profession (T5).
- Students need to be able to understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology (E3).
- Students need to be able to integrate the knowledge and tools of biotechnology for their application to different industrial sectors that use, develop or produce biotechnological products or processes (E6).

**QUALIFICATION** (Explanation of the qualification system)

The evaluation of the course (final grade, FG) will take into consideration the grades obtained in the final exam (FE), the follow-up activities (FA), the reports and presentations (RP), and the participation (P). Each of these marks will range from 0 to 10.

The qualification of the follow-up activities (FA) will be calculated as the average of the different activities carried out. The qualification of the reports and presentations (RP) will be calculated as the average of the different activities carried out. The participation grade (P) will be awarded at the end of the course after assessing the student’s commitment and participation in the overall activities.

The objective of the final exam (FE) is to assess the synthesis of the course. It will consist of two parts corresponding to the two thematic section of the subject, which will have the following specific weight: Section I (60%) and Section II (40%).

In order to pass the subject, two requirements must be met:

(i) At least a mark of 3.5 has to be achieved in each of the two parts.
(ii) The FE mark must be equal to or greater than 4.5. This note is calculated as:

\[ FE = 0.6 \text{ Section I} + 0.4 \text{ Section II} \]

In the event that the mark of one of the two parts of the EF is lower than 3.5, or that the mark of the EF is lower than 4.5, this mark will be the final grade (FG) of the course. In the recovery exam, the student may keep the marks of the parties that are greater than or equal to 3.5.

In the case where the FE mark is higher than 4.5, then the final grade (FG) of the subject is calculated as the average of the grades obtained in the final exam (FE, 50%), the follow-up

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activities (FA, 10%), the reports and presentations (RP, 30%), and the participation (P, 10%), following the following formula:

$$FG = 0.5 \text{ FE} + 0.1 \text{ FA} + 0.3 \text{ RP} + 0.1 \text{ P}$$

Only if this final grade (FG) is equal to or greater than 5 will the subject be passed.

It is mandatory that students attend a minimum of 75% of the classes of each of the two section of the course.

ASSESSMENT OF THE COMPETENCES (Describe the grading system for each competence in relation with the assessment tasks)

For the evaluation of competences B5, T3, T5, E3 and E6, the final exam grade, follow-up activities, reports and presentations and participation will be used as indicators.

BIBLIOGRAPHY (Recommended and accessible to the student.)

The bibliography will be recommended at the beginning of each section.

DOCUMENT HISTORY

PREVIOUS REVISIONS (Indicate date and author / s, first the most recent one)

CURRENT REVISION (Indicate date and author / s)
March 1st, 2019. Dr Ciril Jimeno, Dr Teresa Pellicer