COURSE: DOWNSTREAM PROCESSES

SUBJECT MATTER: Bioprocesses
MODULE: Bioprocess Engineering
PROGRAM: Degree in Biotechnology

GENERAL FEATURES *
Type: ☐ Basic training, ☑ Compulsory, ☐ Elective
☐ Final Degree Project, ☐ Practicum
Duration: Semestral Semester / s: 5
Number of ECTS credits: 5
Language / s: Spanish, Catalan, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION (of the meaning of the course in relation to the studies. Between 100 and 200 words)

Separation and purification of different biological products may account for more than 50% of the total costs of the Bioprocess at industrial scale, being the critical factor to reach the final commercialization of the product.

This course aims to provide the students with the basic concepts of different separation and purification process, the theoretical bases and the scale-up methodology.

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

- That students know how to apply their knowledge to their work or vocation in a professional manner, and have acquired the competencies that allow them to elaborate and defence arguments as well as to solve problems within their area of study. (CB2)
- 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 understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology. (E3)
- Be able to use tools, systems or processes to carry out the activities in the field of Biotechnology according to the established requirements. (E4)
- 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)

Basics of Process Engineering and Bioreactors

* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).
CONTENTS  (List the content of the course, with up to two level detail)

1. Introduction
2. Cell Disruption
3. Filtration
4. Sedimentation and centrifugation
5. Liquid-liquid Extraction
6. Adsorption
7. Liquid Chromatography
8. Precipitation
9. Final formulation

METHODOLOGY

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>1,1</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Case and Problem-Solving Sessions</td>
<td>0,4</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Seminars</td>
<td>0,1</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Practical and Lab Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentations</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Personal Study</td>
<td>3,3</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Assessment Tasks (Exams, Continuous Assessment...)</td>
<td>0,1</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5,0</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
</tbody>
</table>

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

The teaching methodology will be based on the following 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.
- **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.

* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).
• 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 (FE)</td>
<td>40%</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Midterm Exam/s</td>
<td>-</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Continuous Assessment Activities (CAA)</td>
<td>35%</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Reports and Presentations (RP)</td>
<td>20%</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Lab or Field Work</td>
<td>-</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Projects</td>
<td>-</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Host Student Evaluation</td>
<td>-</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
<tr>
<td>Participation (P)</td>
<td>5%</td>
<td>CB2, CB5, T3, E3, E4, E6</td>
</tr>
</tbody>
</table>

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

• Students have to know how to apply their knowledge to their work or vocation in a professional manner, and have acquired the competencies that allow them to elaborate and defence arguments as well as to solve problems within their area of study (CB2).
• Students have to develop those learning skills necessary to undertake further studies with a high degree of autonomy (CB5).
• Students have to be able to assess the impact of their professional activity on the sustainable development of society (T3).
• Students have to be able to understand and apply advanced knowledge of Biosciences and Engineering to the field of Biotechnology (E3).
• Students have to be able to use tools, systems or processes to carry out the activities in the field of Biotechnology according to the established requirements (E4).
• Students have 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 course evaluation will consider the qualifications of the Continuous Assessment Activities (CAA), the Reports and Presentations (RP), the Participation (P) and the Final Exam (FE).

The qualification of the Continuous Assessment Activities (CAA, 35% of the final grade) will be calculated as the arithmetic mean of all performed activities, consisting of problem resolution. Submit a minimum of 80% of the activities is compulsory as well as to get a minimal grade of 35% (p.e. 3.5/10) to pass the course. In case the student gets a grade equal or over 75% (p.e. 7.5/10), the student will have the option to not perform the problem section on the Final Exam (70% of the Final Exam, FE).

The qualifications of Reports and Presentations (RP, 20% of the final grade) will correspond to the reports and/or exercises asked during the subject. The submission of all the activities, before the deadline proposed by the Professor, with a minimal grade of 40% is compulsory to perform the Final Exam. Submit the activities after the deadline will be taken in to account as not presented unless proper justification.

The Participation qualification (P, 5% of the final grade) will be adjudged by the Professor at the end of the course taking into account the level of participation of the student, specially in the exercises discussion and/or scientific articles.

The Final Exam (40% of the final grade) aims to assess the synthesis of the course (The student has to get a minimal grade of 4.5/10 in the Final Exam to pass the course). EF will be have a theoretical part, 30% of the FE, and a part of exercises, 70% of the FE. The exercises section of the FE may be compensated if the student gets a grade equal or over 75% in the Continuous Assessment Activities. In this case, the qualification of the exercise section on the FE will be the same as the CAA grade.

The Final Qualification (FQ) of the course will be calculated as follow:

\[ FQ = 0.4 \text{ FE} + 0.35 \text{ CAA} + 0.20 \text{ RP} + 0.05 \text{ P} \]

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

Assessment will be performed as following:

<table>
<thead>
<tr>
<th>Competences</th>
<th>Assessment depending on the performed activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB2</td>
<td>50% RP + 50% FE</td>
</tr>
<tr>
<td>CB5</td>
<td>100% FQ</td>
</tr>
<tr>
<td>T3</td>
<td>100% FQ</td>
</tr>
<tr>
<td>E3</td>
<td>50% CAA + 50% FE</td>
</tr>
<tr>
<td>E4</td>
<td>50% CAA + 50% FE</td>
</tr>
<tr>
<td>E6</td>
<td>100% FE</td>
</tr>
</tbody>
</table>

* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).
COURSE: DOWNSTREAM PROCESSES

SUBJECT MATTER: Bioprocesses
MODULE: Bioprocess Engineering
PROGRAM: Degree in Biotechnology

BIBLIOGRAPHY (Recommended and accessible to the student)


DOCUMENT HISTORY

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

CURRENT REVISION (Indicate date and author / s)
February 20th 2019, Dr. Marc Carnicer Heras

* These features should not be modified without the approval of the academic board (subject matter, module and / or studies program).