Universitat Autònoma de Barcelona

**2023/2024**

# Analysis and Synthesis of Bioprocesses

Code: 100962
ECTS Credits: 6

| Degree | Type | Year | Semester |
|---|---|---|---|
| 2500253 Biotechnology | OB | 3 | 2 |

## Contact

Name: Pau Ferrer Alegre

Email: pau.ferrer@uab.cat

## Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

## Prerequisites

The syllabus does not determine any specific prerequisite for this subject. However, due to its integrating nature of the different knowledge acquired throughout previous courses, the recommendation is to have passed the maximum number of subjects possible before taking it. In any case, they are essential to be able to properly follow the basic principles of bioprocess engineering, bioreactors and separation and purification processes.

## Objectives and Contextualisation

Introduce to the student the concepts and practice of the integrated synthesis of bioprocesses, that is, in the selection and matching of a set of unit operations (stages of the process) for the production of a product, service at an acceptable cost and quality.

Acquire comprehension and practice in the analysis of biotechnological processes in terms of engineering, economics, compliance with regulations, quality, intellectual property, etc.

Introduce to the student the most important tools used in the analysis and to be able to use these tools in the evaluation and comparison of different solutions (proposals) of design of a determined process.

Overall, it is a subject where we intend to integrate / synthesize knowledge acquired in other subjects of the degree for the design (synthesis and analysis) of bioprocesses.

## Competences

- Display an integrated vision of an R&D&I process, from the discovery of the basic knowledge and the development of applications to market launch, and apply the main concepts of organisation and management to a biotechnological process.
- Identify the strategies for producing and improving products in different sectors using biotechnological methods and display an integrated vision of the R&D&I process.
- Make an oral, written and visual presentation of one's work to a professional or non-professional audience in English or in one's own language.
- Read specialised texts both in English and one's own language.
- Reason in a critical manner
- Search for and manage information from various sources.
- Think in an integrated manner and approach problems from different perspectives.
- Work individually and in teams

## Learning Outcomes

1. Design a process for obtaining products through biotechnology.
2. Design an industrial process for obtaining products using biotechnology, from the initial discovery, through the various production stages, to market launch.
3. Make an oral, written and visual presentation of one's work to a professional or non-professional audience in English or in one's own language.
4. Read specialised texts both in English and one's own language.
5. Reason in a critical manner
6. Search for and manage information from various sources.
7. Think in an integrated manner and approach problems from different perspectives.
8. Work individually and in teams

## Content

1. Analysis of bioprocesses

1.1. Characteristics of the biotechnological industries.

1.2. Structure of bioprocesses. The stages of the development and design of a process.

1.3. Analysis of bioprocesses: Economic, environmental and social sustainability assessment.

2. Synthesis of bioprocesses: Selection, arrangement and integration of steps of bioprocesses

2.1. Synthesis of the biocatalyst.

2.2. Synthesis of upstream stages and of the cultivation/bioreaction system and strategy.

2.3. Synthesis of the recovery and purification stages of the product.

2.4. Bioprocess integration and intensification. Biorefineries

2.5. The quality of the process and product.

3. Design of bioprocesses:

3.1. Biotechnology applied to human and animal health.

3.2. Industrial biotechnology and agro-food.

3.3. Environmental biotechnology.

## Methodology

Teaching will be carried out with face-to-face theoretical classes.
In addition to the theoretical classes, seminars will be held on specific as

biotechnological process case introduced in the seminars, of their choice. They will presented a writen report on
The subject is registered in the Virtual Campus and all the materials used

in a specific topic.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Seminars | 15 | 0.6 | 6, 1, 2, 4, 7, 5 |
| Theoretical classes | 30 | 1.2 | 6, 1, 2, 4, 7, 5 |
| Type: Supervised | | | |
| Compulsory group work | 50 | 2 | 6, 3, 4, 8 |
| Type: Autonomous | | | |
| self study | 47 | 1.88 | 6, 1, 2, 4, 7, 5 |

## Assessment

During the course, three partial exams will be carried out, previously announced, which will represent 75% of the final mark as a whole. To do the average with the rest of the marks, a minimum mark of 4 (out of 10) is needed in each partial exam.

The compulsory group work, selected from the 4 case studies of the syllabus presented in the Seminars sessions, will represent 25% of the final grade.

To participate in the recovery exam, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Valuable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade

Students who do not pass the partial examinations may perform a recovery exam of the whole theoretical part, which will have a weight of 75% (which will be added to the the compulsory group work assessment with a 25% weight that is not recoverable).

***Single-call evaluation***

The single-call evaluation consists of a single synthesis exam that covers the whole theory program of the subject (that is, it replaces the three partial exams). The synthesis exam will have the same type of questions as the partial exams. This exam will have a weight of 75 % of the overall subject.

Students that choose the single-call evaluation modality must participate in the group work case study. The evaluation and weight on the overal grade of the group work assignement will be the same as for the continuous evaluation modality (25%).

The syntesis exam will bescheduled on the same day that the last partial exam of the continuous evaluation, and the same second-chance examination procedure will apply.

To pass the subject, a minimum grade of 4 (over 10) must be achieved in the synthesis exam.

## Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Compulsory group work | 25% | 0 | 0 | 6, 3, 4, 7, 8 |
| Partial exams | 75% | 6 | 0.24 | 1, 2, 7, 5 |
| Recovery exam | 75% | 2 | 0.08 | 1, 2, 7, 5 |

## Bibliography

- Heinzle E., Biwer A., Cooney C. 2006. Development of Sustainable Bioprocesses:Modelling and Assessment. John Wiley & Sons, Ltd. (ref. biblioteca UAB: 66.09, CDROM:RED/674).

- Atkinson B., Mavituna F. 1991. Biochemical Engineering and Biotechnology Handbook. (ref. biblioteca UAB: 66.09Atk)

- Flickinger M.C., Drew S.W. 1999. Encyclopedia of Bioprocess Technology:Fermentation, Biocatalysis and Bioseparation. John Wiley and Sons, Inc. (ref. bibliotecaUAB: 66.09)

- Turton R., Bailie R.C., Whiting W.B., Shaeiwitz J.A. 2003. Analysis, synthesis, and design of chemical processes. 2nd edition. Prentice Hall PTR. (ref. biblioteca UAB: 66.02Ana)

- Biotechnology: a multi-volume comprehensive treatise (edited by H.J. Rehm and G. Reed) 2nd completely revised edition. Weinheim, VCH, 1993-2001 (ref. biblioteca UAB: 5(03) 79 Bio).

- Kirk-Othmer Encyclopedia of Chemical Technology (recurs electrònic) (Accés restringit als usuaris de la UAB: http://onlinelibrary.wiley.com/book/10.1002/0471238961)

## Software

In order to elaborate and present the assay on the case study, alumni will have to use a standard ofimatics software