

**Basic Bioprocesses Engineering**

Code: 100960  
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OB	2	1

**Contact**

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**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**Teachers**

Antonio Javier Moral Vico

**Prerequisites**

There are no incompatibilities.

**Objectives and Contextualisation**

The general objective of this course is to learn the principles that govern the biotechnological processes carried out at full-scale.

Specific objectives include:

1. Perform the balances of energy and mass involved in these processes.
2. Use the phenomena of heat and mass transport associated with these processes.
3. Interpret the flow diagrams in which these processes are represented.
4. Use properly the units used in mathematical expressions.

**Competences**

- Describe the principles behind the design and functioning of bioreactors and calculate, interpret and rationalise the main parameters in transport phenomena and the matter and energy balances in bioindustrial processes.
- Learn new knowledge and techniques autonomously.
- Use ICT for communication, information searching, data processing and calculations.
- Use the fundamental principles of mathematics, physics and chemistry to understand, develop and evaluate a biotechnological process.
- Work individually and in teams

## Learning Outcomes

1. Apply matter and energy balances in bioindustrial processes.
2. Describe the units, variables and characteristics of transport phenomena.
3. Explain matter and energy balances in bioindustrial processes.
4. Learn new knowledge and techniques autonomously.
5. Solve problems in different key aspects of bioindustrial processes.
6. Solve problems in matter and energy balances in bioindustrial processes.
7. Use ICT for communication, information searching, data processing and calculations.
8. Work individually and in teams

## Content

1. Introduction.
  - 1.1. Units systems
  - 1.2. The international system of units
  - 1.3. Numerical methods
    - 1.3.1. Search zeros in nonlinear equations
    - 1.3.2. Differential equations
    - 1.3.3. Numerical integration
    - 1.3.4. Numerical derivation
    - 1.3.5. Interpolation and adjust
2. Mass balance without chemical reaction
  - 2.1. General systems. Simple cases
  - 2.2. Calculation basis. Complex systems
  - 2.3. Non steady state
3. Systems with chemical reaction
  - 3.1. Concept of conversion and yield
  - 3.2. Isothermal chemical reactors
4. Energy balance
  - 4.1. Global Balance
  - 4.2. Heat energy
  - 4.3. Energy in chemical reactors
5. Transport phenomena
  - 5.1. Bases
  - 5.2. Transport coefficients

## Methodology

Methodology combining different activities:

Classes of theory: it is a master class taught by the theory teacher who, in some cases, has audiovisual support that is available in the Virtual Campus of the course. In classrooms, it is possible to propose practical examples.

Classes of problems: that will focus on lesson problems that are presented in the Virtual Campus of the course, with different grades of complexity. The problem-solving classes will consider a limited number of problems. Apart from these problems, other ones are at the disposition of the students to do them autonomously. Also, blocks of more problems are at teacher's disposition and in the bibliography of the course.

It is important to note that some of the problems require a numerical resolution that exceeds the ability of the students. For this reason, in Theme 1 is presented a software to help the student to solve them. The software is presented in a specific session.

Theory classes are done in a single group, whereas the classes of problems are divided into two groups (A and B). The student has to consult in which group is included.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Type: Direct	1	0.04	7, 6
Type: Direct	30	1.2	1, 2, 3, 5
Type: Supervised			
Type: Supervised	15	0.6	1, 7, 6, 5
Type: Autonomous			
Type: Autonomous	30	1.2	1, 7, 2, 6, 5
Type: Autonomous	66	2.64	1, 3, 6, 5

## Assessment

The evaluation system is based on a continuous assessment that combines different activities:

Continuous assessment activities: 100%

- Activity 1 (Test Unit 1): 25%
- Activity 2 (Test Unit 2): 25%
- Activity 3 (Test Unit 3): 25%
- Activity 4 (Test Unit 4): 25%

To pass the course will take a minimum of five as the average grade of the continuous evaluation. All activities must have been evaluated. Students who do not attend an activity will be evaluated with a 0 in that activity.

Students that do less than 3 activities will not be evaluated. Students who fail the course with continuous assessment can make a final examination, including any part of the course and calculated in 100%.

Students who wish to increase qualification can also do this final examination. In this case, the qualification of the continuous assessment will not be considered. The minimum grade to pass the final exam is again 5.

Without prejudice to other disciplinary action deemed appropriate and in accordance with the academic regulations in force, it will qualify with a zero irregularities committed by the student that may lead to a change in the qualification of an act of evaluation. Therefore, to copy any assessment activity will imply not to pass the course.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activity 2	25%	2	0.08	1, 7, 2, 3, 6, 5, 8
Activity 3	25%	2	0.08	1, 7, 2, 3, 6, 5, 8
Activity 4	25%	2	0.08	1, 7, 2, 3, 6, 5, 8
Deliverables	25%	2	0.08	4, 7, 8

## Bibliography

Elementary principles of chemical processes. Felder, Richard M. New York, Wiley, cop. 2000.

(Principios elementales de los procesos químicos, Felder, Richard M. México : Limusa Wiley, cop. 2003, 3ª ed.)

Doran, P.M. (1995). Bioprocess Engineering Principles, Academic Press, London.

(Principios de ingeniería de los bioprocesos, Doran, Pauline M. Zaragoza: Acribia, cop. 1998)

Himmelblau, D.M. (1974). Basic Principles and Calculations in Chemical Engineering, 3rd edn, Prentice-Hall, New Jersey.

(Principios básicos y cálculos en ingeniería química, Himmelblau, David M. México: Prentice-Hall Hispanoamericana, cop. 1997, 2ª ed.)

Perry, R.H.; Green, D.W. (1997). Perry's Chemical Engineers' Handbook (7th Edition).. McGraw-Hill.

Díaz, M. (2012). Ingeniería de Bioprocesos. Paraninfo.