COURSE DATA

Data Subject	
Code	33184
Name	Introduction to biochemical engineering
Cycle	Grade
ECTS Credits	4.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	90 - Biochemical engineering	Obligatory

Coordination

Name	Department
BADIA VALIENTE, JOSE DAVID	245 - Chemical Engineering

SUMMARY

The subject Introduction to Biochemical Engineering is a compulsory subject that is taught in the second year of the Degree in Biotechnology by the University of Valencia, during the second semester, and consists of 4.5 credits.

Based on previous concepts introduced in basic subjects (physics, chemistry, biology, mathematics), the subject introduces a series of tools that will allow a quantitative approach to biotechnology on an industrial scale.

On the one hand, the application of conservation laws will be addressed through the approach of material and energy balances. On the other hand, the kinetic laws that define the speed equations in physical processes will be worked on and justified.

This practical approach will be complemented by introducing an overview of biochemical engineering that will be developed more specifically in other subjects of the degree.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is suggested to pass previously the next subjects in order to affront with guaranties the matter: Mathematics I, Mathematics II and Chemistry.

OUTCOMES

1102 - Degree in Biotechnology

- Saber aplicar los conocimientos en Biotecnología al mundo profesional.
- Capacidad de interpretar datos relevantes.
- Capacidad para transmitir ideas, problemas y soluciones dentro de la Biotecnología.
- Develop skills to undertake further study.
- Capacidad para trabajar en el laboratorio incluyendo seguridad, manipulación, eliminación de residuos y registro anotado de actividades.
- Conocer los fundamentos de los fenómenos de transporte y saber plantear y utilizar los balances de materia y energía en los procesos bioindustriales.
- Saber utilizar la lengua inglesa en la redacción de informes y para interpretar información a partir de protocolos, manuales y bases de datos.

LEARNING OUTCOMES

At the end of the subject, the main learning outcomes that the student must acquire are the following:

- Know how to interpret a material flow diagram

- Consider material and energy balances in different contexts related to the biotechnological

industry

- Use the property transport velocity equations in simple applications.

- Know how to interpret and use the information necessary to solve the practical cases proposed.

- Handle industrial application equipment and devices

- Become familiar with specialized bibliographic sources to find, select and understand information.

- Know how to critically analyze the results obtained both when solving problems and when carrying out laboratory practices.

- Write reports and reports clearly and in order.

DESCRIPTION OF CONTENTS

1. Introduction

Definition of Biochemical Engineering. Biotechnology industry processes: continues and batch mode. Definition of Basic Operation. Calculations and data presentation in engineering processes.

2. Mass balances

Formulation of balances. Total mass balance. Total amount of substance balance. Mass balance applied to a component. Mass balances applied in systems with recirculation, derivation or purged streams. Application of material balances: nonreacting systems in steady and unsteady state. Stoichiometry of growth and elemental balances.

3. Energy balances

Total energy balance. Enthalpy balance. Application to systems without chemical reaction in steady and unsteady state. Application to fermentation processes. Mechanical energy balance.

4. Introduction to transport phenomena.

Transport mechanisms: molecular and turbulent. Rate equations in molecular transport. Turbulent transport: Definitions of transport coefficients.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	21,00	100
Classroom practices	12,00	100
Laboratory practices	10,00	100
Tutorials	2,00	100
Attendance at events and external activities	2,50	0
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	10,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	6,00	0
Preparation of practical classes and problem	9,00	0
Resolution of case studies	6,00	0
Resolution of online questionnaires	2,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The methodology to be used in the subject will consider the following aspects:

Theory sessions: Students will be offered a global vision of the subject to be dealt with and the key concepts to be developed will be emphasized, as well as the resources to be used for the subsequent preparation of the subject in depth. As it is an eminently applied subject, in these sessions some practical applications will be considered, by way of example, in order to enhance the assimilation of the concepts introduced. The theory classes will be taught in a single group.

Sessions of practical classes: In these sessions, on the one hand, the teaching staff will carry out a series of problems-type of each one of the contents that are developed. On the other hand, the student will work on similar problems, with supervision. Likewise, practical applications for autonomous work will be proposed. These sessions will take place in the classroom with groups of 40 students.

Laboratory practices: The student will work with various experimental setups and will become familiar with the use of computer tools for data processing and analysis. Concepts developed in the theoretical and practical sessions will be worked on, so as to promote their assimilation. The practices that can be done are:

- Material balance applied to a component, in a non-steady state.

- Energy balance, in non-steady state.

Group tutorials: 2 group tutorial sessions will be scheduled throughout the course, in which the teachers will try to clarify concepts and resolve any doubts that may have arisen while carrying out the problems proposed throughout the course.

EVALUATION

The evaluation of the learning will be carried out considering independently the laboratory work (LAB) and the theoretical-practical part (TP), each part having to be approved independently.

Evaluation of laboratory practices (LAB) (15% of the final mark):

The evaluation of the laboratory will be made from the memories of each one of the 2 practices carried out (2 deliverables, associated with the practices of material and energy balance, respectively, with a valuation of 40% each memory) and from an exam that will take place on the date of the first official call (20%). Attendance to the practical sessions in the laboratory is mandatory and necessary to pass the subject. Students who have failed the laboratory practices part of the subject in the ordinary call, for not having attended the sessions in the laboratory, will not have another opportunity to carry out the practices. Students who have failed the laboratory practice part of the subject in the ordinary call, for not having delivered all the results reports, or for not having delivered them within the indicated period, or for having obtained a final grade of less than 5 (out of 10), in each of them, or in the laboratory exam, they will have the possibility of passing in an extraordinary call, provided that they deliver the results reports and/or take the written test again on the date of the extraordinary call.

Evaluation of the theoretical-practical part (TP) (85% of the final grade)

The evaluation of the theoretical-practical part will be the highest of the two modalities (A and B) that are presented below, both in ordinary call and in extraordinary call:

A. Grade=85% Objective test (min=4.5)+15% Work.

B. Note= 50% Objective test (min=4.5) + 50% Work.

The works will consist of a collection of questionnaires and deliverable problems, individually and/or in groups. No individualized or weighted minimum score is established in this category.

The objective test will consist of questions and problems in which the assimilation of the concepts and procedures worked on in the subject will be demonstrated. A minimum of 4.5 is required to weight.

Overall evaluation

The global evaluation of the subject will be quantified by means of a weighted average of these two parts, with a relative weight of 85% in the theoretical-practical part (TP) and 15% in the laboratory (LAB).

In case of not passing any of the parts (LAB or TP), the qualification will be the minimum of them.

In case of approving only one of the parts in the ordinary call, its mark will be kept for the extraordinary call.

Marks from any of the sections will not be kept between academic courses.

REFERENCES

Basic

- Principios de ingeniería de los bioprocesos.
  P.M. Doran (Ed. Acribia)
- Ingeniería Bioquímica.
  F. Gòdia Casablancas, J. López Santín (editores) (Ed. Síntesis)
- Introducción a la Ingeniería Química
  J.F. Izquierdo, J. Costa, E. Martínez de la Ossa, J. Rodríguez y M. Izquierdo (Ed. Reverté)

Additional

- Material and Energy Balances
  G.V. Reklaitis (Ed. Wiley)
- Introducció a l'Enginyeria Química
  A. Aucejo, D. Benaiges, A. Berna, M. Sanchotello, C. Solà (Ed. Biblioteca Universitària)
- Biochemical Engineering Fundamentals
  J.E. Bayley y D.F.G. Ollis (Ed. McGraw-Hill)