

**COURSE DATA****DATA SUBJECT**

Code: 36883
Name: Introduction to biochemical engineering
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1111 - Grado en Biotecnología	Facultat de Ciències Biològiques	2	Second quarter, First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1111 - Grado en Biotecnología	Biochemical engineering	COMPULSORY

COORDINATION

BADIA VALIENTE JOSE DAVID

GIL CASTELL OSCAR

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 6 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

Relationship with other subjects of the same degree

No enrollment restrictions have been specified with other subjects in the curriculum.

Other types of requirements

It is recommended to previously take and pass the following first-year subjects in order to be able to face the subject with guarantees: Mathematics I, Mathematics II and Chemistry.

COMPETENCES / LEARNING OUTCOMES

-

Actuar con autonomía en el aprendizaje, tomando decisiones fundamentadas en diferentes contextos, emitiendo juicios en base a la experimentación y el análisis y transfiriendo el conocimiento a nuevas situaciones

Apply analytical, synthetic and critical thinking skills in the application of the scientific method.

Colaborar eficazmente en equipos de trabajo, asumiendo responsabilidades y funciones de liderazgo y contribuyendo a la mejora y desarrollo colectivo

Conocer las etapas de procesamiento de materiales anterior y posterior a una etapa de biorreacción a escala industrial

Conocer los fundamentos de transporte y saber plantear y utilizar balances de materia y energía en los procesos bioindustriales

Conocer los principios básicos de las principales operaciones utilizadas en la industria biotecnológica.

Contribuir en el diseño, desarrollo y ejecución de soluciones que den respuesta a demandas sociales, teniendo en cuenta como referente los Objetivos de Desarrollo Sostenible

Demostrar razonamiento crítico y autocrítico en el ámbito de la titulación, considerando aspectos tales como la ética profesional, los valores morales y las implicaciones sociales de las diferentes actividades realizadas

Participate in multidisciplinary teams, engaging in teamwork and collaboration.

Propose creative and innovative solutions to complex situations or problems, typical of the area of connection, to donate responses to the various professional and social needs

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las



características de la situación y de la audiencia

Saber interpretar un diagrama de flujo de materiales

Ser capaz de llevar a cabo el dimensionado y análisis de los biorreactores más comunes, de la esterilización térmica del medio de reacción a escala industrial y del aire, así como de los procesos de agitación y aireación en un biorreactor a nivel industrial

Ser capaz de plantear alternativas plausibles en el proceso de recuperación de producto a escala industrial

Understand the principles of the design and functioning of bioreactors.

Use English to write reports and to interpret information from protocols, manuals and databases.

Work in laboratories, including safety procedures, waste management and accurate activity logging.

DESCRIPTION OF CONTENTS

1. 1. Introduction to biochemical engineering. Definition of biochemical engineering. Operating methods in the biochemical industry. Basic operating concepts. Engineering analysis and presentation of results.
2. 2. Mass balances. General property balance. Total material balance. Material balance applied to a component. Steady-state material balance. Unsteady-state material balance. Calculation basis. Recirculating, bypassing, and/or purging systems. Residence time. Growth stoichiometry and elemental balances.
3. 3. Energy balances. Total energy balance. Potential, kinetic, internal energy, and flow work. Steady-state energy balance. Unsteady-state energy balance. Mechanical energy balance. Enthalpy balance. Heat energy balance in fermentation systems.
4. 4. Introduction to transport phenomena. Transport mechanisms: molecular and turbulent. Velocity equations in molecular transport. Turbulent transport: transport coefficients.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	30,00
Laboratory	10,00
Classroom practices	18,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES



Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	20,00
Preparation of lessons	15,00
Preparation for assessment activities	33,00
Resolution of case studies	2,00
Total hours	90,00

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.

The distribution of in-person hours is as follows:

Theory 30 hours

Practice 18 hours

Tutorials 2 hours

Labs 10 hours

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=5.0)+15% Work.

B. Note= 50% Objective test (min=5.0) + 50% Work.

The works will consist of a collection of questionnaires, activities and/or 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 5.0 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

**10.1 Basic references**

Reference b1:	<i>Principios de ingeniería de los bioprocesos.</i> <i>P.M. Doran (Ed. Acribia)</i>
Reference b2:	<i>Ingeniería Bioquímica.</i> <i>F. Gòdia Casablanca, J. López Santín (editores) (Ed. Síntesis)</i>
Reference b3:	<i>Introducción a la Ingeniería Química</i> <i>J.F. Izquierdo, J. Costa, E. Martínez de la Ossa, J. Rodríguez y M. Izquierdo (Ed. Reverté)</i>

10.2 Complementary references

Reference c1:	<i>Material and Energy Balances</i> <i>G.V. Reklaitis (Ed. Wiley)</i>
Reference c2:	<i>Introducció a l'Enginyeria Química</i> <i>A. Aucejo, D. Benaiges, A. Berna, M. Sanchoello, C. Solà (Ed. Biblioteca Universitària)</i>
Reference c3:	<i>Biochemical Engineering Fundamentals</i> <i>J.E. Bayley y D.F.G. Ollis (Ed. McGraw-Hill)</i>