Teaching guide

IDENTIFICATION DETAILS

Degree:	Biotechnology
Scope	Biology and Genetics
Faculty/School:	Experimental Sciences
Course:	BIOCHEMICAL ENGINEERING
Type:	Compulsory
ECTS credits:	6
Year:	2
Code:	2027
Teaching period:	Fourth semester
Subject:	Biotechnological Process Engineering
Module:	Biotechnology Tools
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

Biochemical Engineering is the discipline dedicated to the development, design, operation and maintenance of process units involving living organisms or their molecules. By teaching the subject Biochemical Engineering in the degree in Biotechnology, it is intended that students acquire the necessary knowledge and know the basic tools that allow them to understand the fundamentals of transport and enzymology phenomena, essential for them to be able to describe and understand biotechnological processes.

GOAL

The general objective of the Biochemical Engineering course is to provide students with the basic competencies to describe and understand biotechnological processes in their application at the industrial level, integrating and systematizing the main tools required during the development stage. In addition, students are encouraged to develop habits of critical thinking and approach to scientific rigor, as well as to enhance their ability to relate the concepts of this subject to other areas of knowledge, assimilating the complex nature of reality. Due to the impact of biotechnologists on society, it is considered a cross-cutting objective to promote student commitment and responsibility in the search for the common good and improvement of society.

The specific aims of the subject are:

Interpret and apply the fundamentals of enzymatic and microbial kinetics, understand their importance and applications in the industry for obtaining products of food, medical, environmental interest, etc.

Understand the basic fundamentals of engineering for the design of biotechnological processes on an industrial scale.

Interpret and apply the relevant parameters in transport phenomena and in the balances of matter and energy in bioindustrial processes.

PRIOR KNOWLEDGE

The student who studies the subject of Biochemical Engineering will obtain optimal use of the subject if they have the level of knowledge of the 1st degree in Biotechnology for the subjects of Foundations of Mathematics, Foundations of Physics, General Chemistry and Foundations of Biochemistry.

COURSE SYLLABUS

Topic 1 Introduction to Biochemical Engineering
1.1 Systems of quantities and units
1.2 Block diagrams and flow charts
1.3 Basic operations
1.4 Forms of operation
Topic 2 Kinetics of biological processes
2.1 Kinetics of enzymatic reactions
2.2 Enzyme Activity Assays
2.3 Kinetics of irreversible enzyme deactivation
Theme 3 Conservation of matter in biotechnological processes
3.1 General equation for the conservation of matter
3.2 Simplifications
Topic 4 Introduction to fluid flow
4.1 Viscosity of fluids
4.2 Rheological classification of fluids
4.3 Laminar flow and turbulent flow
4.4 Boundary layer

Topic 5 Introduction to the transfer of matter
5.1 Balance between phases
5.2 Transport of matter by diffusion
5.3 Convective transport of matter
5.4 Transport of matter in discontinuous and continuous unit operations
5.5 Transport of matter in heterogeneous reactions
Topic 6 Energy Balances in Biotechnological Processes
6.1 General energy conservation equation
6.2 Enthalpic balances
6.3 Mechanical Balances
6.4 Heat transfer mechanisms

EDUCATION ACTIVITIES

TEACHING-LEARNING ACTIVITIES RELATED TO FACE-TO-FACE WORK

Participatory expository classes: Participatory expository sessions in which the theoretical and practical contents of the subject are developed.
Seminars: individual and/or group work for the resolution and discussion of practical cases where techniques and knowledge related to the subject are applied.
Tutoring: personalized orientation of the student in the process of learning the subject at the time assigned by the teacher for this purpose. Resolution and discussion of questions that may arise for the student, as a result of the study and autonomous maturation of the subject.

ACTIVITIES RELATED TO SELF-EMPLOYMENT

Study of subjects: study of the theoretical contents of the course program. Use of the complementary materials designed in the virtual network spaces of the subject as well as consultation of the bibliographic sources proposed in the bibliography.
Solving exercises and case studies: solving practical assumptions on an individual basis.
Tutoring preparation: preparation of the issues to be raised and discussed in the tutorials.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
60 Horas	90 Horas

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study.

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

To acquire firm theoretical, practical, technological and humanistic training needed to develop professional activity.

To acquire essential engineering knowledge for designing and scaling instruments needed to develop a biotechnological process.

To have acquired the ability for analytical, synthetic, reflective, critical, theoretical and practical thought.

Capacity for problem-solving and decision-making.

To understand the fundamental laws and principles of physics, mathematics, chemistry and biology as the foundation for the mental structure of a biotechnician.

To acquire the skills needed for experimental work: design, preparation, the compilation of results and the obtainment of conclusions, understanding the limitations of an experimental approach.

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Specific skills

Calculate and correctly interpret the relevant parameters in transport phenomena and the balances of matter and energy in bioindustrial processes.

Acquire the technological and engineering knowledge necessary for process design.

Know and understand the structure and function of enzymes and their applications in the biotechnology industry.

Know how to describe, quantify, analyze and critically evaluate the results obtained from experimental work carried out in the laboratory.

Develop habits of rigorous thinking.

Know how to apply the theoretical knowledge acquired to solving problems and practical cases related to different subjects.

Know how to work as a team in an effective and coordinated way.

LEARNING RESULTS

Define a bioprocess from a kinetic and stoichiometric view

Apply the abstraction process to extract relevant information from a practical case using appropriate mathematical methods.

Acquire analysis and synthesis skills.

Develop skills in understanding and analyzing scientific works.

Develop critical thinking.

Identify which areas and knowledge of Biotechnology are being appliced

Proposal of alternative solutions to the problem or proposed case

Interpret the meaning of the kinetic parameters that describe an enzymatic process, as well as the phenomena that may alter it.

Apply different kinetic equations for the modeling of microbial growth.

Design and resolve material balances applied to a biotechnological process.

Use properly the equations that describe the transport phenomena involved in a bioprocess, applying the equation of conservation of mechanical energy in fluid transport, as well as describing and classifying the rheological behavior of fluids based on experimental data.

LEARNING APPRAISAL SYSTEM

REGULAR EVALUATION SYSTEM
The ordinary evaluation system for the subject Biochemical Engineering includes the evaluation of all activities carried out in the teaching-learning process of the subject, with the following percentages:
EV1 Final Exam (65%)
The final exam will be carried out to evaluate the overall learning of the contents presented in the theoretical-practical expository classes. The student will demonstrate in writing and/or orally their assimilation, understanding and ability to relate the contents presented, as well as the analysis, calculation and resolution of problems framed in the subject.
- In order to pass the subject, the student requires a minimum score of 5 (out of 10) in the knowledge test (EV1).
- Students who obtain a score equal to or greater than 5 (out of 10) in the EV1 activity, but do not pass the subject in the ordinary call, will keep their grade until the extraordinary call of the same academic year.
EV2 Partial knowledge tests (15%)
The partial knowledge tests will be used to monitor the student's learning during the course. These tests will not release subject matter from the final exam. A minimum grade is not required in this section to be evaluated.
-Students who obtain a score equal to or greater than 5 (out of 10) in the EV2 activity during the course, but do not pass the subject in the ordinary call, will keep their grade until the extraordinary call of the same academic year.
-Since no type of recovery is contemplated in this section in the extraordinary call, students who do not obtain a score equal to or greater than 5 (out of 10) during the course will add the percentage of this activity to the weight of the knowledge test of the extraordinary call.
EV3 Seminars (20%)
The execution, presentation and discussion of the deliverables required at each seminar will be evaluated. Attendance at the seminars is mandatory to pass the course. The score for this activity corresponds to the weighted average (depending on the dedication required to complete the deliverables of each seminar) of all the reports and activities delivered, and must be equal to or greater than 5 (out of 10) to successfully pass the EV3 activity.
-Students who obtain a score equal to or greater than 5 (out of 10) in the EV2 activity during the course, but do not pass the subject in the ordinary call, will keep their grade until the extraordinary call of the same academic year.
- Students who do not exceed the minimum required score (5 out of 10) will receive the appropriate guidelines to recover this part of the subject in the extraordinary call, either by submitting a report through the Virtual Classroom within the deadline specified by the teacher or by taking a specific exam in the extraordinary call.
The subject will be approved when the final grade obtained, weighting according to the percentages described above, is equal to or greater than 5 out of 10.
ALTERNATIVE EVALUATION SYSTEM
For students in second and subsequent enrollment, the following evaluation system will be applied, with the following percentages:
EV1 Final Exam (65%)
Just like the ordinary system.
EV2 Partial knowledge tests (15%)
Just like the ordinary system.
EV3 Seminars (20%)
If the weighted average of section EV3 in previous courses was greater than 5, the average for the alternative

evaluation system will be maintained.
Students who do not exceed the minimum required score (5 out of 10) will receive appropriate guidelines to recover this part of the subject during the course, either by submitting a report through the Virtual Classroom within the deadline specified by the teacher or by taking a specific exam.
Five school days are available at the beginning of the course to inform teachers of their intention to take advantage of the alternative evaluation system. If no communication is received, the default alternative system will apply.

Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the University's Coexistence Regulations

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:
a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.
2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.
3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Guillermo Calleja Pardo (editor), Francisco García Herruzo... [et al.]. New introduction to chemical engineering/Madrid:Synthesis, 2016.

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John Villadsen, Jens Nielsen, Gunnar Lidén. Bioreaction Engineering Principles/3rd ed. New York: Springer, 2011.

SHULER, Michael L. Bioprocess Engineering: Basic Concepts/2nd ed. Essex:Pearson, 2014.

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Enrique Battaner Arias. Compendium of Enzymology/Salamanca: Ediciones Universidad de Salamanca, 2013.

Additional

A. Barba Juan, C. Clausell Terol. Solved problems of chemical and biochemical reactors/Castelló de la Plana:Universitat Jaume I. Servei de Comunicació i Publicacions, [2015]

B. Atkinson. Biochemical reactors/Barcelona: Reverté, 2002.