COURSE DATA

DATA SUBJECT

Code: 46563
Name: Biotechnological processes
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2261 - Master's Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2261 - Master's Degree in Chemical Engineering	Optatividad	ELECTIVES

COORDINATION

PEÑARROCHA OLTRA JOSEP MANUEL

SUMMARY

"Biotechnological Processes" is an optional subject of the Master in Chemical Engineering taught in Valencian in the second semester. It consists of 3 ECTS credits.

In order to provide the basic information for implementation and/or operation of bioprocesses on an industrial scale, the core of the course focuses on the peculiarities of biological reaction, mainly in mass transfer aspects (especially important in aerobic processes) and scaling-up; and in the design of sterilization at industrial scale. To provide an overview of biotechnology processes, the course is complemented by the study of typical examples of bioprocesses and downstream processing for biotechnology

The subject will be developed from the following contents:

- Introduction to industrial microbiology.
- Bioreactors: advanced designs, mass transfer, heat transfer and sterilization. Introduction to scale-up.
- Downstream processing in biotechnology.
- Bioprocesses technologies for waste treatment. Other applications of bioprocesses.

LEARNING OUTCOMES (RD 1393/2007): Know fundamentals of microbial agents used in industral bioprocesses. Deepen on knowledge of bioreaction configurations and downstream processing on biotechnology. Deepen analysis of case studies on the design and use of bioprocesses.

In addition to those specified in the verified memory, the following will be obtained: Be able to size and to analyze agitation and aeration of bioreactors at industrial scale. Be able to size and to analyze sterilization at industrial scale. Know how to interpret and use information to solve practice cases. Develop skills to handle specialized bibliographic sources for finding, selecting and understanding the information. Be able to critically analyze the results of practical applications. Be able to write reports with clarity and order.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

No prerequisites are needed for this subject

COMPETENCES / LEARNING OUTCOMES

2261 - Master's Degree in Chemical Engineering

Adapt to changes and be able to apply new and advanced technologies and other relevant developments with initiative and entrepreneurship.

Apply critical reasoning to their knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience and practice, in order to establish economically viable solutions to technical problems.

Be able to access information tools in different areas of knowledge and use them properly.

Be able to apply the scientific method and the principles of engineering and economics to formulate and solve complex problems in processes, equipment, facilities and services in which matter changes its composition, state or energy content, these changes being characteristic of the chemical industry and of other related sectors such as pharmacology, biotechnology, materials science, energy, food or the environment.

Be able to assess the need to complete their technical, scientific, language, computer, literary, ethical, social and human education, and to organise their own learning with a high degree of autonomy.

Be able to defend criteria with rigor and arguments and to present them properly and accurately.

Be able to solve unfamiliar and ill-defined problems that have specifications in competition by considering all possible methods of solution, including the most innovative ones, and selecting the most appropriate, and correct implementation by evaluating the different design solutions.

Be able to take responsibility for their own professional development and specialisation in one or more fields of study.

Communicate and discuss proposals and conclusions in specialised and non-specialised multilingual forums, in a clear and unambiguous manner.

Direct and supervise all types of facilities, processes, systems and services in different industrial areas related to chemical engineering.

DESCRIPTION OF CONTENTS

1. Introduction

Introduction to industrial microbiology. Historical and socioeconomic context of biochemical engineering. Applications in bioprocesses. Advanced designs of bioreactors.

2. Mass transfer in bioreactors

Mass transfer.
Aeration: gas-liquid mass transfer.
Agitation: Forced convection mass-transfer.

3. Sterilization in Bioprocesses

Heat sterilization and heat transfer in bioreactors. Discontinuous sterilization of media. Continuous sterilization of media. Air sterilization.

4. Scale-up of bioreactors

Bases of scale-up. Media sterilization. Aeration-agitation. Regime analysis and scale-down.

5. Applications in bioprocesses and downstream processing for biotechnology

Applications in bioprocesses. Bioprocess technologies for waste treatment. Downstream processing for biotechnology.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Classroom practices	10,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	6,00
Independent study and work	12,00
Preparation of lessons	14,00
Preparation for assessment activities	8,00
Resolution of case studies	5,00
Total hours	**45,00**

TEACHING METHODOLOGY

The teaching methodology used in the subject will consider the following aspects:

Lecture sessions: An overview of the topic will be exposed and key concepts will be stressed to be developed. Information on resources will be offered to be used for the preparation of the subject in depth. Some practical cases will be worked to enhance the acquisition of concepts.

Practical lessons: Practical questions and problems to be solved by students will be proposed. The professor will work a number of problems-type, exercises and case studies to promote the acquisition of skills on the various aspects of the subject.

EVALUATION

The evaluation of the subject is based on the following items:

1. Objective test (75% of grade): Based on a written test with theoretical and practical questions.
2. Practical activities (20% of grade): Based on written work submitted to the professors (reports, problems solved, etc) and/or individual specific tests.
3. Continuous assessment (5% of grade): Based on regular course attendance and classroom activities.

The subject will be passed when the weighted average mark is equal to or greater than 5 (out of 10), being

mandatory to obtain in the objective test a mark equal or greater than 4.5 (out of 10). If the mark of the objective test is below 4.5 (out of 10) that will be the global mark of the subject. Whatever the case, it can be chosen the test to be the global mark of the subject.

REFERENCES

- Basic:

Principios de ingeniería de los bioprocesos. P.M. Doran (Ed. Acribia)

Ingeniería Bioquímica. F. Gòdia Casablancas y J. López Santín, editores (Editorial Síntesis)

Biochemical Engineering. S. Aiba, A.E. Humprey y N.F. Millis (Academic Press)

Bioseparations: downstream processing for biotechnology. Belter, P.A., Cussler, E.L., Wei-Shou Hu. (John Wiley and Sons)

Principles of fermentation technology. P.F. Stanbury, A. Whitaker and S.J. Hall (Butterworth-Heinemann)

Ingeniería de Bioprocesos. M. Díaz Fernández (Ed. Paraninfo)

- Additional:

Biochemical Engineering Fundamentals. J.E. Bayley y D.F.G. Ollis (McGraw-Hill)

Biochemical engineering. H.W. Blanch y D.S. Clark (Marcel Dekker)

Basic Bioreactor Design. Van¿t Riet, K., Tramper, J. (Marcel Dekker)

Bioseparations Science and Engineering, R.G. Harrison, P. Hodd, S.R. Rudge, D.P. Petrides, (OxfordUniversity Press.)

Bioprocess Engineering: Kinetics, Sustainability, and Reactor Design. L. Shijie (Elsevier)

Biochemical engineering: a textbook for engineers, chemists and biologists. S. Katoh and F. Yoshida (Weinheim)

Biochemical engineering and biotechnology. G.D. Najafpour (Elsevier)