VNIVERSITAT DE VALÈNCIA

Course Guide
33191 Industrial bioprocesses

COURSE DATA

Data Subject	
Code	33191
Name	Industrial bioprocesses
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	4	Second term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	101 - Industrial bioprocesses	Optional

Coordination

Name	Department
SAN VALERO TORNERO, PAU	245 - Chemical Engineering

SUMMARY

For the implementation of full-scale biotechnological applications it is necessary the ability of proposing and studying several feasible alternatives and be able to carry out the selection of the optimal configuration from analysis of economical criteria. Besides, in order to develop or operate a bioprocess at full-scale, the biotechnologist needs a series of conceptual tools and skills that enable him to deal with facilities, instrumentation and process control systems. Thus, from a global and integral approach, this course deals with conceptual tools and skills necessary for the conception or operation of an industrial-scale bioprocess.

This is an elective course to be developed in the fourth year of the degree in biotechnology with a workload of 4.5 ECTS. The topics of the course are grouped into three sections:

- Process strategy and economical evaluations

- Control and instrumentation of bioprocesses

- General services and facilities for industrial bioprocesses (water, energy, steam, compressed air)

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 recommended to have passed the subjects included in the module of Biochemical Engineering to successfully work this subject.

OUTCOMES

1102 - Degree in Biotechnology

- Capacidad de interpretar datos relevantes.
- Conocer los diferentes tipos de procesos biotecnológicos asociados a la producción industrial.
- Diseñar procesos de manipulación y obtención de productos biotecnológicos.

LEARNING OUTCOMES

At the end of the course, the student must have acquired the following skills:

- Be able to interpret and use information from various types of flowcharts.

- Set out alternatives that can solve a biotechnological problem at industrial scale and select those alternatives most appropriate.

- Be able to understand and estimate basic economic concepts (investment, costs, sales revenues, profits, taxes, net cash flow) required for the economic evaluation of a bioprocess industry.

- Be able to assess the economic viability of a bioprocess using basic economic parameters.

- Be able to use methods of selection of investment alternatives in bioprocesses.

- Have knowledge of sensors for physical and chemical parameters and be able to select the most appropriate for a particular control in a given industrial bioprocess.

- Have knowledge about the various components of a control system in a bioprocess industry.

- Be able to interpret process control schemes.

- Be able to implement an on/off or PID (proportional-integral-derivative) in a bioprocess.

- Be able to understand the basics of advanced methods of control and digital control.

- Know how industrial equipment for the generation and distribution of steam works.

- Know the basis for network design in industrial water.

- Know the basis for compressed air and other industrial gases distribution.

- Be able to understand the basics of electrical installations.

- Know the basis of the configuration of electrical lines and their risks.

- 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.

- Write reports with clarity and order

DESCRIPTION OF CONTENTS

1. Introduction to process strategy

Bioprocesses technology for obtention of biotechnology products:
- Characteristic case studies.
- Identification of alternatives.

2. Economic aspects of process strategy

Investment, costs, net cash flow.
Evaluating and selecting alternatives
Optimization

3. Control and instrumentation of industrial bioprocesses

Control system elements: physical or chemical sensors, controller; final control element.
- Feedback control: on/off and proportional-integral-derivative (PID) controller.
- Advanced control systems
Industrial control systems
Digital control

4. Facilities for biotech processes

Sources of energy supply for biotechnology industries.
Calculating and estimating energy requirements.
Electrical facilities.
Steam production and use: equipment and facilities.
Compressed air: equipment and facilities.
Supply and conditioning of water process.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	28,00	100
Laboratory practices	15,00	100
Tutorials	2,00	100
Development of group work	3,00	0
Development of individual work	3,00	0
Study and independent work	20,00	0
Readings supplementary material	3,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	7,00	0
Resolution of case studies	10,00	0
Resolution of online questionnaires	1,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The methodology used in the course will consider the following aspects:

Lecture sessions: Single group to introduce the theoretical and practical principles of the course.

Practical lessons: case studies and practical applications will be developed in groups of 16 students in a regular classroom. In some sessions, students will work with experimental setups and equipment in use and will use software for processing and analysis of data.

Tutorials: Students will be divided into small groups and participate in sessions to evaluate the development of the course.

EVALUATION

The evaluation of the course will take place as follows:

1. Continuous assessment and practical activities (50% of grade): Based on written work given to the professors (reports, solved problems, etc) and/or individual specific tests.

2. Objective test (50% of grade): Based on a written test with theoretical and practical questions.

The course will be over passed when the weighted average grade is equal to or greater than 5 (out of 10), being mandatory to obtain in the objective test a grade equal or greater than 4.0 (out of 10). In the case of lower grade in the objective test, this will be the 100 % of the final grade.

REFERENCES

Basic

- Biochemical engineering and biotechnology handbook. B Atkinson y F. Mavituna. Ed. Stockton Press.
- Ingeniería Bioquímica. F. Gòdia Casablancas y J. López Santín (editores). Editorial Síntesis.
- Analysis synthesis and design of chemical processes. R. Turton et al. Ed. Prentice-Hall.
- El pronóstico económico en química industrial. A. Vian. Quimica e Industria.
- Evaluación de inversiones industriales. R. Jordá. Ed Alhambra.
- Control e instrumentación de procesos químicos. P. Ollero de Castro y E. Fernández Camacho. Editorial Síntesis.
- Manual de instalaciones hidráulicas, sanitarias, gas, aire comprimido y vapor (2ª ed). S. Zepeda. Editorial Limusa.
- Instalaciones eléctricas de baja tensión comerciales e industriales: cálculos eléctricos y esquemas unifilares. A. Lagunas Marqués. Thomson. Paraninfo.

Additional

- Principios de ingeniería de los bioprocesos. P.M. Doran. Editorial Acribia.
- Bioseparations science and engineering. R.G. Harrison et al. Ed. Oxford.
- Analysis synthesis and design of chemical processes. R. Turton et al. Ed. Prentice-Hall.
- Plant design and economics for chemical engineers. M.S. Peters y K.D. Timmerhouse. Ed. McGraw-Hill.
- Chemical process control: an introduction to theory and practice. G. Stephanopoulos. Ed Prentice-Hall.
- Tecnología Energética. V. Bermudez. Editorial UPV.

- Instalaciones eléctricas. A. J. Conejo, J.M. Arroyo y F. Milano, F. McGraw-Hill España, 2007.