VNIVERSITAT DE VALÈNCIA

Course Guide
33186 Basic operations in biotechnological processes

COURSE DATA

DATA SUBJECT

Code: 33186
Name: Basic operations in biotechnological processes
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1111 - Grado en Biotecnología	Facultat de Ciències Biològiques	3	Second quarter

SUBJECT-MATTER

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

COORDINATION

PEÑARROCHA OLTRA JOSEP MANUEL

CHAFER ORTEGA AMPARO

SUMMARY

This course is integrated within the Biochemical Engineering subject area. The subject "Basic operations on biotechnological processes" is a matter of compulsory nature which is cursed on the third course of the Degree on Biotechnology of the University of Valencia, during the second quarter. It consists on 6,0 credits. On biotechnological applications at industrial scale, the raw materials were modified by reactions which take place on the bioreactors. In this sense, the physical changes first and/or posterior the reactions are of great importance for prepare the raw materials or the extraction and purification of the final product. At industrial level, the term "basic operation" is referred to the physical steps on biotechnological processes. In this context, the subject "Basic operations on biotechnological process" has the aim to introduce the basic principles of the main physical steps or basic operations which the biotechnology uses at industrial scale. Which this propose, the subject will be build on the concepts previously introduced on the matter "Introduction to biochemistry engineering", cursed on the second course of the degree, as well as on the subjects of basic nature as physic, chemistry, biology and mathematics.

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 and II on the first course.
- Introduction to Biochemistry Engineering on the second course.

COMPETENCES / LEARNING OUTCOMES

1102 -

Capacidad de interpretar datos relevantes.

Capacidad para trabajar en el laboratorio incluyendo seguridad, manipulación, eliminación de residuos y registro anotado de actividades.

Capacidad para transmitir ideas, problemas y soluciones dentro de la Biotecnología.

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

Develop skills to undertake further study.

Saber aplicar los conocimientos en Biotecnología al mundo profesional.

Saber diseñar y ejecutar un protocolo completo de obtención y purificación de un producto biotecnológico.

Saber utilizar la lengua inglesa en la redacción de informes y para interpretar información a partir de protocolos, manuales y bases de datos.

1111 - Grado en Biotecnología

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 procesado 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. Introduction.Processing of materials on the biotechnological industries. Classification of basic operations. Introduction to the separation strategies and flux diagrams. 2. Basic operations of movement quantity transport.Fluids flux. Bombes. Filtration. Centrifugation. 3. Basic operations on heat transfer. Equipment for heat transfer. Design of industrial heat exchangers. Evaporators. 4. Basic operations of mass transfer. Separation operations by membranes. Adsorption. Liquid-liquid extraction. Crystallization. Drying. 5. Purification sequences on biotechnological industry.Analysis of processing materials schemes. Approach of sequences separation and purification of products.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,50
Theory	27,00

Laboratory	10,00
Classroom practices	19,50
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	**Hours**
Attendance at other activities	3,50
Individual or group project	25,00
Independent study and work	11,00
Preparation of lessons	31,50
Preparation for assessment activities	16,00
Resolution of case studies	3,00
Total hours	**90,00**

TEACHING METHODOLOGY

The methodology used on the subject is focused on the following points:

Theory sessions: its offers to the student a global vision of the topic to be treated and it will be focused on the key concepts which will be developed, as well as the skills used to prepare a posteriori the subject in depth.

Practice sessions: in these sessions the teacher will explain a series of type problems focused on each of the contents developed. On the other hand, the students will work similar problems conducted by the professor. Finally, it will be proposed practical applications for the autonomy student work. These sessions will be developed on the class room with groups of 40 students.

Laboratory practices: the students will work with several experimental apparatus and use informatics tools in order to analysis and treatment of data. It will work concepts developed on theory sessions, in order to enhance their assimilation. The practices to do are:

- Study of fluids flux and bombes.

- Heat exchangers.

- Centrifugal bombe.

- Experimental study of filtration.

- Air flux through static particle beds.

Group tutorials: it will be 3 group tutorials sessions in the course. In these sessions the professor will explain concepts or solve doubts which can be proposed during the problems sessions of the course.

EVALUATION

Assessment of learning will be carried out by considering the laboratory work and the theoretical-practical component separately; each component must be passed independently. The overall mark for the module will be calculated as a weighted average of both components, with the theoretical-practical component accounting for 85% and the laboratory work for 15%. If only one part is passed in the first sitting, the overall mark for the module in that sitting will correspond to the part that was not passed, and the mark for the passed part will be carried over to the second sitting. Assessment of laboratory practicals: The laboratory assessment will be based on the reports for each of the practicals carried out and on an examination to be held during the final laboratory session. Attendance at laboratory practical sessions is compulsory and essential for passing the module. Students who have failed the laboratory practicals component of the module in the first sitting due to non-attendance at the laboratory sessions will not be given another opportunity to undertake the practicals. Students who have failed the laboratory practical component of the module in the first examination period due to non-attendance at laboratory sessions will not be given another opportunity to undertake the practicals. Students who have failed the laboratory practicals component of the module in the first sitting because they did not submit all the results reports, or because they did not submit them by the specified deadline, or because they obtained a final mark of less than 5 (out of 10), will have the opportunity to pass in the second sitting, provided they submit the results reports and/or retake the written test on the date to be set. Assessment of the theoretical and practical component: The assessment of the theoretical and practical component is based on the following aspects: 1. Continuous assessment and practical activities (30% of the mark). Practical activities will be assessed on the basis of the documentation submitted (assignments, reports or problems presented), accounting for 20% of this component, and a series of objective assessment carried out in the classroom, accounting for 10% of this component. In addition, regular attendance at classes and face-to-face activities will be taken into account and, to a lesser extent, the level of participation and engagement in the teaching-learning process will be considered. 2. Objective test (70% of the mark). A written examination will be held, comprising both theoretical and practical questions and problem-solving tasks. The theoretical and practical component will be deemed to have been passed when the weighted average mark is 5 or above (out of 10), provided that a mark of 4.5 or above (out of 10) is achieved in the objective test. If the mark for the objective test is below 4.5, the weighted average will not be calculated using the continuous assessment and practical activities. In this case, the objective test will account for 100 per cent of the assessment for the theoretical and practical component.

REFERENCES

- Bioseparations: downstream processing for biotechnology Belter, P.A., Cussler, E.L., Wei-Shou Hu. (John Wiley and Sons)
- Bioseparations Science and Engineering, R.G. Harrison, P. Hodd, S.R. Rudge, D.P. Petrides, Oxford University Press.
- Principios de ingeniería de los bioprocesos P.M. Doran (Ed. Acribia)
- Biochemical engineering and biotechnology handbook Atkinson, B. and Navituna F. (Stockton Press)

- Separations for Biotechnology Verrall, M.S., Hudson, M.J. (Eds.) (Ellis Horwood Limited)
- Biochemical Engineering Fundamentals J.E. Bayley y D.F.G. Ollis (McGraw-Hill)
- Flujo de fluidos. Intercambio de calor. Levenspiel, O. (Ed. Reverté)
- Mecànica de Fluids Orchillés, V.A., Sanchotello, M (PUV)
- Transmissió de calor Sanchotello, M., Orchillés, V.A. (PUV)
- Operaciones básicas de ingeniería química McCabe, W.L., Smith, J.C. (Ed. Reverté)