UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: BIOCHEMICAL ENGINEERING
Code: 13338
Type: ELECTIVE
ECTS credits: 4.5
Degree: 341 - UNDERGRADUATE DEGREE PROGRAMME IN BIOCHEMISTRY
Academic year: 2021-22
Center: 501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY
Group(s): 40
Year: 4
Duration: First semester
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **RAFAEL CAMARILLO BLAS** - Group(s): **40**

Building/Office	Department	Phone number	Email	Office hours
Sabatini/0.10	INGENIERÍA QUÍMICA	5414	rafael.camarillo@uclm.es	Prior appointment by mail

Lecturer: **FABIOLA MARTINEZ NAVARRO** - Group(s): **40**

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2. Pre-Requisites

Not established

3. Justification in the curriculum, relation to other subjects and to the profession

In the case of UCLM, the Degree in Biochemistry shows two professional profiles: "Molecular biomedicine", which is the application of Biochemistry to health sector with a biomedical and clinical focus; and "Biotechnology", which is the application of Biochemistry to business and pharmaceutical sectors. In both profiles the student can acquire skills to carry out professional tasks in teaching, industrial and research fields. This knowledge permits the specialization with postgrade and Master programmes in UCLM or any other university.

"Biotechnology" is the "application of scientific and engineering principles to the treatment of organic and inorganic materials by biological systems to produce goods and services". Biotechnology has important applications in industrial sector such as health-care, agriculture, biodegradable plastics, biofuels and bioremediation.

Specifically, "Biochemical Engineering" deals with the transformation of biological materials for the production of products with social and commercial values, using biological systems such as microorganisms (bacteria, fungi, yeasts and algae), enzimes (protease, lipase, ligase) and antibodies.

This subject creates the scientific and technical basis of engineering needed to understand the design and operation of different industrial set-ups involving biological agents. The most important ones are the bioreactors.

The study of principles of biochemical engineering requires basic knowledge in maths, physcis, chemistry and biochemistry.

Moreover, the subject "Biochemical Engineering" complements the contents of other subjects in 4th course, such as "Design of Bioreactors" and "Bioeconomy and business management".

4. Degree competences achieved in this course

Course competences

Code	Description
E01	Express themselves correctly in basic biological, physical, chemical, mathematical and computer terms.
E13	Correct handling of different computer tools
E15	Experimentally determine the concentrations of metabolites, the kinetic and thermodynamic parameters and the control coefficients of the reactions of the intermediate metabolism.
E21	Understand the chemical and thermodynamic principles of biocatalysis and the role of enzymes and other biocatalysts in the functioning of cells and organisms.
G02	To know how to apply the knowledge of Biochemistry and Molecular Biology to professional practice and to possess the necessary intellectual skills and abilities for this practice, including the capacity for: information management, analysis and synthesis, problem solving, organization and planning and generation of new ideas.
G03	Be able to collect and interpret relevant data, information and results, draw conclusions and issue reasoned reports on relevant social, scientific or ethical issues in connection with advances in Biochemistry and Molecular Biology.
G04	To know how to transmit information, ideas, problems and solutions in the field of Biochemistry and Molecular Biology to a specialized and non-specialized public.
G05	Develop those strategies and learning skills necessary to undertake further studies in the area of Biochemistry and Molecular Biology and other related areas with a high degree of autonomy.
T02	User-level knowledge of Information and Communication Technologies (ICT).
T03	A correct oral and written communication
T06	Capacity for design, analysis and synthesis
T10	Ability to self-learn and to obtain and manage bibliographic information, including Internet resources

5. Objectives or Learning Outcomes

Course learning outcomes

Description

In the professional profile "biotechnology", the student is oriented towards professional activity in the business and pharmaceutical fields; he or she also acquires skills to carry out a professional activity in the field of teaching and research.

Additional outcomes

To be able to analyze in detail the installations where the biotechnological processes take place, both at lab and industrial scale, and to differenciate each part thereof: stirring, mixing, aeration, sterilisation, drying, humidification, filtration, settling, centrifugation, etc. To be able to handle different terms related to bioreactors (biochemical and enzimatic).

Other competences: E2 (Working in a good way and motivated by quality in chemical, biological and biochemical lab, including safety, waste handling and disposal and activity log) and E3 (To understand and explain the scientific and chemical basis of biochemical processes and the techniques employed to explore them). This is related to practical activities and technical visit.

6. Units / Contents

Unit 1: Introduction to Biochemical Engineering

Unit 2: Magnitudes and Units Systems

Unit 3: Mass and Energy Balances

Unit 4: Stirring and mixing in bioreactors

Unit 5: Aeration of fermenters

Unit 6: Sterilisation in bioprocesses

Unit 7: Drying and humidification

Unit 8: Separation processes

Unit 9: Introduction to Bioreactors

Unit 10: Labwork and technical visit

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E21	0.58	14.5	Y	N	Participatory lectures (in which questions will be proposed through Turning point). Non-reschedulable in the second resit
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E13 E15 E21 T02	0.6	15	Y	Y	Realization of laboratory practices and treatment of the results. Visit to an industrial facility (if sanitary conditions allow it). It is a NON-RESCHEDULABLE activity
Final test [ON-SITE]	Assessment tests	E01 G04 T03	0.06	1.5	Y	Y	Final test of the subject that will consist of theory
Final test [ON-SITE]	Assessment tests	G04 T06	0.06	1.5	Y	Y	End of course test that will consist of problems
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	E01 E13 G03 G04 T02 T03 T06 T10	0.6	15	Y	Y	The attendace to laboratory practice is COMPULSORY and there is NO rescheduling activity
Study and Exam Preparation [OFF-SITE]	Self-study	G02 G05 T10	1.9	47.5	N	-	Preparation of theory and problems exams
Other off-site activity [OFF-SITE]	Case Studies	E13 G02 G04 T02 T10	0.2	5	Y	N	Delivery of problems proposed by teachers. Completion of tasks (viewing of videos or materials) proposed by teachers through CAMPUS VIRTUAL. Non-reschedulable in the second resit
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E01 T03 T06	0.5	12.5	N	-	Problem solving and exercises in class
		Total:	**4.5**	**112.5**			
		Total credits of in-class work: 1.8					**Total class time hours: 45**
		Total credits of out of class work: 2.7					**Total hours of out of class work: 67.5**

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Laboratory sessions	5.00%	5.00%	Attitude in both laboratory and technical visit will be evaluated, being 4.0 the minimum mark out of 10. The attendance to labwork and technical visit are compulsory
Practicum and practical activities reports assessment	20.00%	20.00%	Minimum mark in laboratory memory is 4.0 out of 10. If not, this part can be passed with specific questions in the test
Final test	32.50%	37.50%	A minimum mark of 4.0 in theory test is required
Other methods of assessment	3.00%	0.00%	Answering to questions raised in class

Final test Other methods of assessment	32.50% 7.00%	37.50% 0.00%	A minimum mark of 4.0 in problems test is required Performing tasks, problems delivery, there is not a minimum mark
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

In all cases, the attendance to labwork and technical visit and the delivery of a lab memory are compulsory. Both attitude in labwork (5 %) and memory (20 %) are evaluated. The final mark is calculated taking into account the marks of final tests (theory test 32.5 % and problems test 32.5 %), lab practices (25 %), case studies (7 %) and answering questions in class (3%).
Minimum mark in some compulsory activities:
-Final test (4.0 in both theory test and problems test)
-Practices (compulsory attendance and 4.0 in both attitude and memory).
To pass the course it will be necessary to obtain a 5.0 out of 10 in the overall mark when taking into account the marks of all the activities.

Non-continuous evaluation:

In all cases, the attendance to labwork and technical visit and the delivery of a lab memory are compulsory. Both attitude in labwork (5 %) and memory (20 %) are evaluated. The final mark is calculated taking into account the marks of final tests (theory test 37.5 % and problems test 37.5 %), lab practices (25 %), case studies (7 %) and answering questions in class (3%).
Minimum mark in some compulsory activities:
-Final test (4.0 in both theory test and problems test)
-Practices (compulsory attendance and 4.0 in both attitude and memory).
To pass the course it will be necessary to obtain a 5.0 out of 10 in the overall mark when taking into account the marks of all the activities.

Specifications for the resit/retake exam:

The mark of each activity will be numerical (0-10).
In the retake evaluation, the final tests will have a weight of 65 % (32.5 + 32.5 %) in final mark. To pass the test, a minimum mark of 4.0 in theory test and problems test is required. If the mark in laboratory memory is smaller than 4.0, the student will be evaluated of practices through a test.
The final mark is calculated taking into account the marks of practices (25 %), case studies (7 %) and answering questions in class (3%), provided that practices and retake exam are passed.
To pass the course it will be necessary to obtain a 5.0 in the overall mark when taking into account the marks of all the activities.
In NON-CONTINUOUS EVALUATION the weight of the final tests is 75 % (37.5 + 37.5 %). If the mark in laboratory memory is smaller than 4.0, the student will be evaluated of practices through a test.
The final mark is calculated taking into account the marks of practices (25 %) and the final exams (75 %), provided that practices and retake exam are passed.
To pass the course it will be necessary to obtain a 5.0 in the overall mark when taking into account the marks of all the activities.

Specifications for the second resit / retake exam:

The mark of each activity will be numerical (0-10).
In the second retake evaluation, the final tests will have a weight of 75 % (37.5 + 37.5 %) in final mark. To pass the test, a minimum mark of 4.0 in theory test and problems test is compulsory.
The final mark is calculated taking into account the mark of practices in previous course (25 %), provided that practices and second retake exam are passed.
To pass the course it will be necessary to obtain a 5.0 in the overall mark when taking into account the marks of all the activities.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	52.5
Unit 1 (de 10): Introduction to Biochemical Engineering	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Unit 2 (de 10): Magnitudes and Units Systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	.5
Unit 3 (de 10): Mass and Energy Balances	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Unit 4 (de 10): Stirring and mixing in bioreactors	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Unit 5 (de 10): Aeration of fermenters	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2.5
Unit 6 (de 10): Sterilisation in bioprocesses	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Unit 7 (de 10): Drying and humidification	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5

Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Unit 8 (de 10): Separation processes	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Unit 9 (de 10): Introduction to Bioreactors	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Unit 10 (de 10): Labwork and technical visit	
Activities	**Hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	15
Global activity	
Activities	**hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	10
Final test [PRESENCIAL][Assessment tests]	3
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	15
Study and Exam Preparation [AUTÓNOMA][Self-study]	52.5
Class Attendance (theory) [PRESENCIAL][Lectures]	17
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Ratledge, C.	Biotecnología básica			8420011332	2009	
Rodríguez, F.	Ingeniería de la industria alimentaria Vol. 2	Síntesis		8477389385	2002	
Rodríguez, F.	Ingeniería de la industria alimentaria Vol. 3	Síntesis		8477389392	2002	
Aguado, J.	Ingeniería de la industria alimentaria Vol. 1	Síntesis		8477386681	2002	
Casablancas, G.	Ingeniería bioquímica	Síntesis		8477386117	2005	
Najafpour, G.	Biochemical engineering and biotechnology			0444528452	2007	
Quintero Ramírez, R.	Ingeniería bioquímica: teoría y aplicaciones	Alhambra Mexicana		968-444-017-0	1987	