UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: BIOCHEMICAL ENGINEERING
Code: 57725
Type: CORE COURSE
ECTS credits: 6
Degree: 344 - CHEMICAL ENGINEERING
Academic year: 2023-24
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Group(s): 21
Year: 3
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ANA MARIA BORREGUERO SIMON** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Enrique Costa Novella/Despacho 12	INGENIERÍA QUÍMICA	6353	anamaria.borreguero@uclm.es	Wednesday, Thursday and Friday from 10 to 11. Preferably make an appointment via email.

Lecturer: **CARMEN MARIA FERNANDEZ MARCHANTE** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Enrique Costa Novella/Despacho 14	INGENIERÍA QUÍMICA	6351	carmenm.fmarchante@uclm.es	Monday, Wednesday and Thursday: 12:30 a 13:30 h

Lecturer: **ESTER LÓPEZ FERNÁNDEZ** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
	INGENIERÍA QUÍMICA		Ester.LFernandez@uclm.es	

2. Pre-Requisites

Not established

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

Subject belonging to Module 3 (Specific technology in Industrial chemistry). Biochemical engineering is concerned with the study, planning, design and operation of industrial chemical processes in which the transformation stage of raw materials is carried out through biochemical reactions (using different microorganisms) or enzymatic reactions. This type of process is very common in the chemical industry, food and beverage industry, drug production or environmental waste treatment.

4. Degree competences achieved in this course

Course competences

Code	Description
CB05	Have developed the necessary learning abilities to carry on studying autonomously
E19	Knowledge about material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, reactor design, and recovery and transformation of raw materials and energy resources.
E21	Capacity for the design and management of applied experimentation procedures, especially for the determination of thermodynamic and transport properties, and modeling of phenomena and systems in the field of chemical engineering, systems with fluid flow, heat transfer, mass transference, kinetics of chemical reactions and reactors.
G04	Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Chemical Engineering.
G16	Management capacity and information planning
G17	Capacity for critical thinking and decision making
G18	Synthesis capacity
G19	Capacity for teamwork
G20	Ability to analyze and solve problems
G21	Ability to learn and work autonomously
G22	Ability to apply theoretical knowledge to practice

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To have knowledge to adequately control the functioning of biotechnological processes.

To have knowledge to design operations of conditioning of substrates and processing of products in biochemical processes.

To have knowledge to design enzymatic reactors.

To have knowledge to design industrial fermentors.

To know how to select among several alternatives in a biotechnological process.

6. Units / Contents

Unit 1: Biochemical reactors
Unit 2: Enzyme reactors
Unit 3: Agitation and mixing
Unit 4: Aeration of Fermenters
Unit 5: Drying solids
Unit 6: Lyophilization
Unit 7: Esterification of Culture Media
Unit 8: Biotechnology processes of industrial interest

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	CB05 E19 E21 G04 G16 G17 G18 G20 G22	1.4	35	N	-	
Mid-term test [ON-SITE]	Assessment tests	CB05 E19 E21 G04 G16 G17 G18 G19 G20 G22	0.1	2.5	Y	Y	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB05 E19 E21 G04 G16 G17 G18 G19 G20 G22	0.2	5	Y	Y	
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	CB05 E19 E21 G04 G16 G17 G18 G19 G20 G21 G22	0.6	15	Y	Y	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	CB05 E19 E21 G04 G19 G21	0.1	2.5	N	-	
Study and Exam Preparation [OFF-SITE]	Self-study	CB05 E19 E21 G04 G16 G17 G18 G19 G20 G21 G22	3.6	90	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

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
Practicum and practical activities reports assessment	10.00%	10.00%	The elaboration of practice memoirs in the classroom is included.
Mid-term tests	65.00%	0.00%	The progress tests go into the evaluation option.
Laboratory sessions	15.00%	15.00%	The realization of laboratory practices is an activity.
Assessment of problem solving and/or case studies	10.00%	10.00%	Solving problems or global cases is done.
Final test	0.00%	65.00%	
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:

The criteria indicated in each of the training activities and the percentages of the evaluation system shall apply. To approve the subject in each of the sections will require a minimum of a 4.0/10 and the average must be equal to or greater than 5.0/10.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

They follow the same criteria as in the ordinary.

Specifications for the second resit / retake exam:

The character of compulsory realization, the minimum note, and the recoverable character is maintained as in the ordinary call.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	35
Mid-term test [PRESENCIAL][Assessment tests]	2.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	5
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	15
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Global activity	

Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	35
Mid-term test [PRESENCIAL][Assessment tests]	2.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	5
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	15
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Okafor, N. y Okeke B.C	Modern Industrial Microbiology and Biotechnology	CRC Press - Taylor & Francis Group		9781138550186	2017	
Shuler, M.L	Chemical Engineering Problems in Biotechnology	American Institure of Chemical Engineers		0-8169-0469-3	1989	
Steudler, S., Werner, A., Cheng, J.J	Solid State Fermentation: Research and Industrial Applications.	Springer		3030236757, 97830302	2019	
Katoh, S., Horiuchi, J. y Yoshida, F.	Biochemical engineering: a textbook for engineers, chemists and biologists.	Wiley-VCH Verlag GmbH & Co. KGaA, cop		978-3-527-33804-7	2015	
B. Atkinson, F. Mavituna	Biochemical engineering and biotechnology handbook	Macmillan Publishers Ltd.	U.K.	0-333-33274-1	1983	
ATKINSON, Bernard	Biochemical engineering and biotechnology handbook	Stockton Press		0-943818-02-8	1987	
AIBA, Shuichi	Biochemical engineering	Academic Press		0-12-045052-6	1973	
Atkinson, B.	Reactores bioquímicos	Reverté		84-291-7009-X	1986	
BAILEY, James E.	Biochemical engineering fundamentals	McGraw-Hill		0-07-003212-2	1986	
Dutta, Rajiv	Fundamentals of biochemical engineering	Ane Books India Springer		978-81-8052-202-4	2008	
Lee, James M.	Biochemical engineering	Prentice Hall		0-13-085317-8	1992	
Quintero Ramírez, Rodolfo	Ingeniería bioquímica : teoría y aplicaciones	Alhambra mexicana,		968-444-017-0	1987	
Ratledge, Colin; Kristiansen, Bjorn	Biotecnología básica	Zaragoza : Acribia, D.L		978-84-200-1133-2	2009	
Gòdia Casablancas, Francesc; López Santín, Josep; Casas Alvero, Carlos	Ingeniería bioquímica	Síntesis		84-7738-611-0	1998	
Kent, J. A.; Bommaraju, T.; Barnicki, S. D.	Handbook of Industrial Chemistry and Biotechnology	Springer		978-3-319-52287-6	2017	
Kirk y Othmer	Enciclopedia de Tecnología Química	Limusa S.A		968-18-5576-0	1998	
Scragg, A	Biotecnología para Ingenieros: sistemas biológicos en procesos tecnológicos	Limusa S.A		978-968-18-4708-1	2008	