UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: UNIT OPERATIONS IN FOOD AND PHARMACEUTICAL INDUSTR
Code: 57733
Type: ELECTIVE
ECTS credits: 6
Degree: 344 - CHEMICAL ENGINEERING
Academic year: 2023-24
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Group(s): 21
Year: 4
Duration: First semester
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ANTONIO DE LUCAS CONSUEGRA** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
Enrique Costa Novella/Despacho 7	INGENIERÍA QUÍMICA	+34926295217	antonio.lconsuegra@uclm.es	Monday, tuesday, wednesday from 10:00 to 11:00

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

Building/Office	Department	Phone number	Email	Office hours
	INGENIERÍA QUÍMICA		Ester.LFernandez@uclm.es	Monday, Tuesday and Thursday from 9:00 to 11:00

Lecturer: **ANGEL PEREZ MARTINEZ** - Group(s): **21**

Building/Office	Department	Phone number	Email	Office hours
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2. Pre-Requisites

Not established

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

This subject belongs to the module 4 ENGINEERING OF CHEMICAL PROCESSES AND ENERGY The fundamental objective of the subject is to expand the knowledge acquired from the subject Separation Operations. In most industrial processes it is usual to have to carry out a mechanical separation with solids, with solid-liquid or liquid-liquid systems. For this reason, it is very convenient to study two very common basic operations: filtration and centrifugation. The student must know the theoretical foundations, the design equations, the equipment and the industrial applications of these two operations controlled by the transport of momentum. The processes of separation with membrane begin to be used systematically in the treatment of sea water, natural waters and aqueous industrial effluents. They are also widely used in the pharmaceutical industry, in the agri-food industry and in the chemical industry. The study of membrane technology will allow the student to know how to classify membrane processes, know their basic principles, the different types of membranes and their corresponding modular configurations, transport models, factors that limit the flow of permeate, modes of operation and the different process configurations

4. Degree competences achieved in this course

Course competences

Code	Description
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
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.
E26	Knowledge about integration of processes and operations
E43	Knowledge about the mode of operation and capacity for the design of the main unit operations used in the pharmaceutical and food industries, in particular mechanical separation operations and membrane processes
G01	Ability to write, sign and develop projects in the field of chemical engineering that are intended, according to the knowledge acquired as established in section 5 of order CIN / 351/2009 of February 9, construction, reform, repair, conservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial facilities and processes and manufacturing and automation processes.
G02	Capacity for the direction, of the activities object of the engineering projects described in the competence G1.
G03	Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and give them versatility to adapt to new situations.
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.
G15	ethical commitment and professional ethics
G17	Capacity for critical thinking and decision making
G20	Ability to analyze and solve problems
G21	Ability to learn and work autonomously
G22	Ability to apply theoretical knowledge to practice
G23	Creativity and initiative

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To have the capacity to design the solid-liquid and liquid-liquid separation equipment most used in the food and pharmaceutical industry.

To know the separation equipment based on membrane technology as well as being able to understand the operation and design them

6. Units / Contents

Unit 1: Bulk solids: properties and characterization. Sieving, size reduction and mixing

Unit 2: Filtration. Cake filtration and deep filtration. Operation modes and design equations. Equipment description

Unit 3: Centrifugation. Solid-liquid and liquid-liquid separation equations. Equipment description

Unit 4: Basic principles of membrane technology

Unit 5: Membrane transport theory

Unit 6: Models for predicting flux. Concentration polarization and fouling.

Unit 7: Process design: modules, modes of operation, cost and process economics.

Unit 8: Ultrafiltration

Unit 9: Ion exchange membrane processes-Electrodialysis.

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	CB02 CB03 E19 E26 E43 G01 G02 G03 G04 G15 G17 G20 G21 G22 G23	1.6	40	N	-	
Workshops or seminars [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 CB03 E19 E26 E43 G01 G02 G03 G04 G15 G17 G20 G21 G22 G23	0.5	12.5	Y	N	
Group tutoring sessions [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 CB03 E19 E26 E43 G01 G02 G03 G04 G15 G17 G20 G21 G22 G23	0.2	5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 CB03 E19 E26 E43 G01 G02 G03 G04 G15 G17 G20 G21 G22 G23	3.6	90	N	-	
Mid-term test [ON-SITE]	Assessment tests		0.1	2.5	Y	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
Assessment of problem solving and/or case studies	25.00%	0.00%	Resolution of tasks, seminars and practical cases of dimensioning of separation units
Mid-term tests	75.00%	0.00%	Resolution of applied theoretical questions and basic problems. The average mark of the partial tests must be equal to five or higher. The minimum mark in the partial tests must be greater than four.
Final test	0.00%	100.00%	Final exam that includes evaluation of all the content and training activities of the subject
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:

To pass the subject a minimum mark of 4/10 in each part should be obtained by the student and an average mark above 5/10.

Non-continuous evaluation:

The student will examine all the material taught and all the activities carried out in the subject, through an exam in the corresponding call, whose grade must be equal to or greater than five

Specifications for the resit/retake exam:

To pass the subject a minimum mark of 5/10 should be obtained in a final exam

Specifications for the second resit / retake exam:

To pass the subject a minimum mark of 5/10 should be obtained in a final exam

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Group tutoring sessions [PRESENCIAL][Project/Problem Based Learning (PBL)]	5
Unit 1 (de 9): Bulk solids: properties and characterization. Sieving, size reduction and mixing	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Unit 2 (de 9): Filtration. Cake filtration and deep filtration. Operation modes and design equations. Equipment description	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	20
Unit 3 (de 9): Centrifugation. Solid-liquid and liquid-liquid separation equations. Equipment description	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 4 (de 9): Basic principles of membrane technology	
Activities	**Hours**
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Unit 5 (de 9): Membrane transport theory	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	9
Unit 6 (de 9): Models for predicting flux. Concentration polarization and fouling.	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	6
Unit 7 (de 9): Process design: modules, modes of operation, cost and process economics.	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	20
Unit 8 (de 9): Ultrafiltration	
Activities	**Hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	8
Unit 9 (de 9): Ion exchange membrane processes-Electrodialysis.	
Activities	**Hours**
Study and Exam Preparation [AUTÓNOMA][Self-study]	6
Global activity	
Activities	**hours**
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	12.5
Group tutoring sessions [PRESENCIAL][Project/Problem Based Learning (PBL)]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas:	107.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
L. Svarovsky	Solid-Liquid Separation	Butterworth-Heinemann	Oxford	0-7506-4568-7	2000	
A. Rushton, A.S. Ward, R.G. Holdich. VCH. Weinheim	Solid-Liquid Filtration and Separation Technology	WILEY - VCH	Weinheim	3-527-28613-6	1996	
AWWARF, Lyonnaise des Eaux and WRCSA	Tratamiento del agua por procesos de membrana. Principios, procesos y aplicaciones.	Mc Graw-Hill	Madrid	0-07-001559-7	1998	
Baker, Richard W.	Membrane technology and applications	John Wiley & Sons		0-470-85445-6	2004	
Cheryan, Munir	Ultrafiltration and microfiltration : handbook	Technomic Publishing Company		1-56676-598-6	1998	
K. Scott and R. Hughes	Industrial membrane separation technology	Blackie	London	0-7514-0338-5	1996	
M. Coulson y J.F. Richardson	Ingeniería Química. Tomo II. Operaciones Básicas	Reverté	Barcelona	84-291-7119-3	1988	
M. Fariñas	Ósmosis Inversa. Fundamentos, tecnología y aplicaciones	McGraw-Hill/Interamericana	Madrid	84-481-2126-0	1999	
M. Mulder	Basic Principles of Membranes Technology	Kluwer Academic Publishers	Dordrecht	0-7923-0978-2	1996	
W.L. McCabe, J.C. Smith & P. Harriott	Operaciones Unitarias. Ingeniería Química	McGraw-Hill	México	970-10-3648-4	2002	
W.S. Winston Ho and Kamalesh K. Sirkar	Membrane Handbook	Chapman & Hall	New York	0-412-98871 -2	1992	
Zeman, Leos J.	Microfiltration and ultrafiltration :	Marcel Dekker		0-8247-9735-3	1996	