UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: DESIGN AND OPERATION OF HETEROGENEOUS REACTORS
Code: 310745
Type: CORE COURSE
ECTS credits: 6
Degree: 2336 - MASTER DEGREE PROGRAM IN CHEMICAL ENGINEERING
Academic year: 2020-21
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Group(s): 20
Year: 1
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **FERNANDO DORADO FERNANDEZ** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
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Lecturer: **ANA RAQUEL DE LA OSA PUEBLA** - Group(s): **20**

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2. Pre-Requisites

Not established

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

Not established

4. Degree competences achieved in this course

Course competences

Code	Description
CB07	To be able to apply acquired knowledge and problem-solving skills in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study
CB10	To possess the learning skills to continue studying in a largely self-directed or autonomous manner.
E01	To apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, with critical reasoning to establish economically viable solutions to technical problems.
E02	To design products, processes, systems and services of the chemical industry, as well as the optimization of others already developed, taking as technological base the diverse areas of the chemical engineering, comprehensive of processes and transport phenomena, separation processes and engineering of the chemical, nuclear, electrochemical and biochemical reactions.
E05	To direct and supervise all types of installations, processes, systems and services of the different industrial areas related to chemical engineering.
G01	To have adequate knowledge to apply the scientific method and the principles of engineering and economics, to formulate and solve complex problems in processes, equipment, facilities and services, in which matter undergoes changes in its composition, state or energy content, characteristic of the chemical industry and other related sectors including the pharmaceutical, biotechnological, materials, energy, food or environmental sectors.
G02	To conceive, project, calculate and design processes, equipment, industrial facilities and services, in the field of chemical engineering and related industrial sectors, in terms of quality, safety, economy, rational and efficient use of natural resources and environmental conservation.
G05	To know how to establish mathematical models and develop them by means of appropriate computing, as a scientific and technological basis for the design of new products, processes, systems and services, and for the optimization of others already developed.
G06	To have the capacity of analysis and synthesis for the continuous progress of products, processes, systems and services using criteria of safety, economic viability, quality and environmental management.
G09	To communicate and discuss proposals and conclusions in multilingual forums, specialized and non-specialized, in a clear and unambiguous way
G11	To possess the skills of autonomous learning in order to maintain and improve the competences of chemical engineering that allow the continuous development of the profession
MC1	To have acquired advanced knowledge and demonstrated an understanding of the theoretical and practical aspects and of the working methodology in the field of Chemical Engineering with a depth that reaches the forefront of knowledge
MC2	To be able, through arguments or procedures developed and supported by themselves, to apply their knowledge, understanding and problem-solving skills in complex or professional and specialized work environments that require the use of creative or innovative ideas
MC3	To have the ability to collect and interpret data and information on which to base their conclusions including, where necessary and relevant, reflection on social, scientific or ethical issues in the field of chemical engineering
MC4	To be able to deal with complex situations or those that require the development of new solutions in the academic, work or professional field of study of Chemical Engineering
MC5	To know how to communicate to all types of audiences (specialized or not) in a clear and precise way, knowledge, methodologies, ideas, problems and solutions in the field of the study of Chemical Engineering
MC6	To be able to identify their own training needs in the field of study of Chemical Engineering and work or professional environment and to organize their own learning with a high degree of autonomy in all kinds of contexts (structured or unstructured).

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To be able to analyze the modifications of the kinetic equation by the appearance of transport phenomena of mass and energy in a reactor when there are two or more phases, or when there are deactivation processes.

To acquire knowledge to calculate and design heterogeneous reactors

To acquire knowledge related to the safety and supervision of the reactor, allowing the complete design of the reactor.

To integrate all the elements studied, allowing the student to approach the complete calculation of the chemical, electrochemical, biochemical and nuclear reactor.

To be able to develop the corresponding mass and energy balances for the different types of reactors.

6. Units / Contents

Unit 1:

Unit 2:

Unit 3:

Unit 4:

Unit 5:

Unit 6:

Unit 7:

Unit 8:

Unit 9:

Unit 10:

Unit 11:

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	E02 E05 G01 G02 G05 G06 MC1 MC6	1	25	N	-	
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	CB07 E01 E02 G01 MC2 MC4	1	25	Y	N	
Group tutoring sessions [ON-SITE]	Guided or supervised work	CB10 G02 G06 G09 G11 MC3 MC5	0.2	5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB07 CB10 E01 G01 G02 G09 G11 MC2 MC4	3.6	90	N	-	
Final test [ON-SITE]	Assessment tests	CB07 E01 G01 MC1 MC2	0.2	5	Y	Y	
		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
Oral presentations assessment	15.00%	15.00%	
Assessment of problem solving and/or case studies	30.00%	30.00%	
Final test	55.00%	55.00%	
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).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Atkinson, B.	Reactores Bioquímicos	Reverté	Barcelona		1986	
Bailey,J.E.; Ollis, D.F.	Biochemical Engineering Fundamentals (2nd Ed)	McGraw-Hill	Nueva York		1986	
Carberry, J.J.	Chemical and Catalytic Reaction Engineering	McGraw-Hill	Nueva York		1976	

Carberry, J.J.; Varma, A.	Chemical Reaction and Reaction Engineering	Dekker	Nueva York		1987
Doraiswamy, L.K. y Sharma, M.M.	Heterogeneous Reactions: Analysis, Examples and Reactor Design	J. Wiley & Sons	Nueva York		1984
Fogler, H.S.	Elements of Chemical Reaction Engineering, 5th edition	Pearson		9780133887822	2016
Froment, G.F.;Bischoff, K.B.; De Wilde, J.	Chemical Reactor Analysis and Design, 3rd Edition	Wiley	Nueva York	978-0-470-56541-4	2010
Gianetto, A.; Silveston, P.L.	Multiphase Chemical Reactors: Theory, Design, Scale-Up.	Hemisphere	Washington		1985
Kunii, D.; Levenspiel, O.	Fluidization Engineering	Krieger	Malabar		1969
Levenspiel, O.	Chemical Reactor Engineering	John Wiley	Nueva York		1999
Orhon, D.; Artan, N.	Modelling of Activated Sludge Systems	Technomic	Lancaster		1994
Santamaría, J.L. y col.	Ingeniería de Reactores	Síntesis	Madrid		1999
Smith, J.M.	Chemical Engineering Kinetics	McGraw-Hill	Nueva York		1981
Trambouze, P.	Chemical Reactors: Design, Enigineering, Operation	Technip	París		1988
Westerperp, K.R.	Chemical Reactor Design and Operation	John Wiley	Nueva York		1984