

**1. General information****Course:** RISK ANALYSIS AND HEALTH AND SAFETY IN THE CHEMICA**Code:** 57738**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:** C2**Main language:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** JUSTO LOBATO BAJO - Group(s): 21

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Enrique Costa/Desp. 6	INGENIERÍA QUÍMICA	6707	justo.lobato@uclm.es	M, Th & Fr from 12:00 to 13:00 h

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2. Pre-Requisites

Not established

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

At one time the nuclear industry was seen as the most likely to be the cause of significant environmental damage, but after the occurrence of several major accidents such as Seveso, Flixborough and Bhopal, that concern extends to much of the chemicals industry. Pressure from society, reflected by strong legislation, coupled with a greater understanding of the impact that chemical processing operations can have, has led to the adoption of higher profile safety and environmental management programs within the chemical industry.

In this subject the students will acquire knowledge and competences related with Risk prevention. A collection of tools and methods which can be utilized to give a quantitative assessment of the risks involved in operating any given process will be introduced in this subject. The aim of this subject is that the authors obtain knowledge, but they are sensitive in a vision of the both active and constructive prevention supported on the connection of the content of the different subjects of the Chemical Engineering Degree.

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.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
E40	Knowledge of the basic norms in matters of occupational health and safety, especially those that are applicable in the Industry and in the Chemical Laboratories
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.
G06	Ability to handle specifications, regulations and mandatory standards.
G10	Ability to work in a multilingual and multidisciplinary environment.
G11	Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer
G15	ethical commitment and professional ethics
G20	Ability to analyze and solve problems
G25	Recognition of diversity, multiculturalism and gender equality

5. Objectives or Learning Outcomes**Course learning outcomes**

Description

To have the ability to identify and assess occupational risks using tools and methods appropriate to the chemical industry environment

Knowledge of the choice of safety equipment in installations.
 Know the legal framework of the prevention of major accidents and occupational hazards.
 To know the methods to prevent and mitigate the consequences of fires
 Conocimientos sobre la elección de equipos de seguridad en instalaciones.
 To acquire knowledge about the evaluation and prevention of exposure to chemical agents.
 To acquire dexterity in the evaluation of the consequences of different accidents
 To acquire the ability to develop emergency and self-protection plans.

Additional outcomes

6. Units / Contents

Unit 1: Safety in the Chemical Industry: Introduction and General concepts

Unit 2: Fundamentals of Occupational Health

Unit 3: Control of Workers Chemical Exposure

Unit 4: Fire Prevention and Extinguishment

Unit 5: Hazard Identification Techniques

Unit 6: Cuantitative Risk Assessment. Fault Tree Analysis

Unit 7: Consequence Analysis in the Chemical Industry

Unit 8: Emergency Planning

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 CB04 E40 G01 G02 G03 G10 G11 G15 G25	1.3	32.5	N	-	
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E40 G01 G02 G04 G06 G11 G15	0.5	12.5	Y	Y	Fire fighting practices and Computer room lab with the Aloha software for Consequence analysis
Workshops or seminars [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 CB04 G01 G02 G04 G06 G10 G11 G15	0.5	12.5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 CB04 E40 G01 G02 G04 G06 G10 G11 G15 G20 G25	3.6	90	N	-	
Progress test [ON-SITE]	Assessment tests	CB02 CB04 E40 G01 G02 G03 G04 G06 G10 G11 G15 G20 G25	0.1	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
Theoretical exam	80.00%	90.00%	
Assessment of problem solving and/or case studies	10.00%	0.00%	
Assessment of activities done in the computer labs	10.00%	10.00%	Computer room lab with the Aloha software for Consequence analysis
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:

Different activities will be carried out during the course for the "Continuous evaluation":

- Exam (80 %) Two exams will be carried out during the course as a continuous evaluation. The average mark must be 5/10 or higher to pass the subject. To make the average, the minimum mark must be 4 in each exam.
- It is mandatory present an individual or "in group" work of the practicum carried out during the course (10 %)
- Resolution of problems or cases proposed during the course is as maximum 10 % of the mark

Those students who do not pass the exams or do not follow the "Continuous Evaluation" have to make an exam about all the contents of the subject.

Non-continuous evaluation:

Practices in the Computer room lab with the Aloha software for Consequence analysis are mandatory.

Specifications for the resit/retake exam:

An exam about all the contents of the subject will be carried out. Furthermore, it is mandatory present an individual or "in group" work of the practicum carried out during the course

Specifications for the second resit / retake exam:

The same as the First Resit/retake exam

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 8): Safety in the Chemical Industry: Introduction and General concepts	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Group 21:	
Initial date: 21/01/2016	End date: 29/01/2016
Unit 2 (de 8): Fundamentals of Occupational Health	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Group 21:	
Initial date: 21/01/2016	End date:
Unit 3 (de 8): Control of Workers Chemical Exposure	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Group 21:	
Initial date: 21/01/2016	End date:
Unit 4 (de 8): Fire Prevention and Extinguishment	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Progress test [PRESENCIAL][Assessment tests]	1.25
Group 21:	
Initial date: 21/01/2016	End date:
Unit 5 (de 8): Hazard Identification Techniques	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Group 21:	
Initial date: 21/01/2016	End date:
Unit 6 (de 8): Quantitative Risk Assessment. Fault Tree Analysis	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Group 21:	
Initial date: 21/01/2016	End date:
Unit 7 (de 8): Consequence Analysis in the Chemical Industry	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	7.5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Group 21:	
Initial date: 21/01/2016	End date:
Unit 8 (de 8): Emergency Planning	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	2
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	10
Progress test [PRESENCIAL][Assessment tests]	1.25
Group 21:	
Initial date: 21/01/2016	End date:
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	32.5
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	14.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	80
Progress test [PRESENCIAL][Assessment tests]	2.5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	20.5
Total horas: 150	

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Falagán Rojo, Manuel Jesús	Higiene industrial : manual práctico	Fundación Luis Fernández Velasco		978-84-931202-9-0	2008	
Menéndez Díez, Faustino	Higiene industrial : manual para la formación del especialista	Lex Nova		84-8406-612-6	2004	
Skelton, Bob	Process safety analysis : An introduction	Institution of Chemical Engineers		0-85295-378-X	1997	
Storch de Gracia, José María	Seguridad industrial en plantas químicas y energéticas : fun			978-84-7978-864-3	2008	
	Enciclopedia de salud y seguridad en el trabajo	Ministerio de Trabajo y Seguridad Social		84-7439-975-3 (t.l)	2001	
	Higiene industrial	Instituto Nacional de Seguridad e Higiene en el		84-7425-603-8	2005	
	Manual de higiene industrial	Fundación Mapfre		84-7100-929-3	1996	
Santamaría Ramiro, J.M., Braña Aísa, P.A.	Process safety analysis : An Risk Analysis and Reduction in the Chemical Process Industry https://link.springer.com/book/10.1007%2F978-94-011-4936-5	Springer		978-94-011-4936-5	1998	
Cortés Díaz, José María	Técnicas de prevención de riesgos laborales : seguridad e hi	Tébar		978-84-7360-272-3	2007	