Course guide
240EQ031 - 240EQ031 - Risk and Safety

Last modified: 26/06/2025

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: **Academic year:** 2025 **ECTS Credits:** 6.0
Languages: Catalan, English

LECTURER

Coordinating lecturer: ELSA PASTOR FERRER

Others: Primer quadrimestre:
ELSA PASTOR FERRER - T10
EULALIA PLANAS CUCHI - T10

PRIOR SKILLS

Calculation skills; use of simulation codes; heat transfer main aspects.

REQUIREMENTS

The courses related to the aforementioned points.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMQ11. Manage and perform verification, control of facilities, processes and products, as well as certifications, audits, inspections, tests and reports.

Generical:
6. Ability to analyze and synthesize to the continued progress of products, processes, systems and services using criteria of safety, affordability, quality and environmental management.

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

TEACHING METHODOLOGY

Blackboard and the usual audiovisual resources.
Exercises solved by the students, individually or in a team.
Analysis of real cases.

LEARNING OBJECTIVES OF THE SUBJECT

With this course, the student whould be able to:
-Identify the different risks associated to industrial plants and activities
-Assess the effects and consequences of the major accidents which can occur in an industrial facilirty or in the transportation of hazardous materials.
- Analyse and quantify the risk.

STUDY LOAD

Type	Hours	Percentage
Hours large group	54,0	36.00
Self study	96,0	64.00

Total learning time: 150 h

CONTENTS

I. Introduction

Description:
1. Introductory concepts
Hazardous materials: types, classification, etc.
Definition of risk. Types
Individual and collective risk
FAR
Tolerability of risk
Types of accidents: fires, explosions, toxic releases
Domino effect
Risk analysis
Historical analysis.

2. Substances dangers
Methodologies for danger identification
Classification of substances
Labelling and risk phrases

3. Methoologies for risks identification and frequencies determination
Hazop
Event trees
Fault trees.

4. Source term
Types of releases
Estimation of flowrates.

Specific objectives:
Learning the essential concepts on risk and major accidents, as well as the methodologies for risk identification and frequencies determination.

Full-or-part-time: 44h 12m
Theory classes: 10h
Practical classes: 6h 12m
Self study : 28h

II. Modelling of major accidents

Description:
6. Fires
Flammability
Types of fires
Modelling
Study of the cases

7. Explosions
Types.
Overpressure wave
Explosions of a gas cloud. Calculation of the overpressure
BLEVE explosions
Smoke explosions
Study of the cases

8. Spread of toxic substances
Atmospherical variables
Models of dispersion
Study of the cases
9. Runaway reactions

10. Vulnerability
Vulnerability of people
Vulnerability of devices

Full-or-part-time: 75h 12m
Theory classes: 16h
Practical classes: 11h 12m
Self study : 48h

III. Methodologies for the risk analysis

Description:
10. Environmental risk
Different aspects
Calculation method

11. Quantitative analysis of the risk
Estimation of the individual risk
Risk maps

12. Security reports

Full-or-part-time: 29h 48m
Theory classes: 6h 30m
Practical classes: 4h 18m
Self study : 19h

ACTIVITIES

1. RESOLUTION OF EXERCISES

Description:
Resolution of exercises in class

Specific objectives:
Application of the theory concepts

Material:
Problem statement, data

Delivery:
No

2. ANALYSIS OF REAL CASES

Description:
Analysis of cases

Specific objectives:
Apply the calculations and theory in a real case

Material:
Information about the accident

Delivery:
In some cases

3. TESTS

Description:
Carry our exercises in class

Specific objectives:
Evaluation

Material:
Bibliographic material

Delivery:
Yes

4. EXAMS

Description:
A partial and a final exam

Specific objectives:
Evaluation

Material:
Bibliographic material

Delivery:
Yes

GRADING SYSTEM

Partial exam (25 %)
Final exam (60 %)
Continuous evaluation (15 %)
Reevaluation: examination of the whole subject
The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

EXAMINATION RULES.

Some exams will be performed using documentation, some without it (students will be previously informed about this aspect).

BIBLIOGRAPHY

Basic:
- Casal Fàbrega, Joaquim. Evaluation of the effects and consequences of major accidents in industrial plants [on line]. Amsterdam: Elsevier, 2018 [Consultation: 22/05/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5056836. ISBN 9780444638922.
- Casal, J., Montiel, H., Planas, E., Vílchez, J. A. Análisis del riesgo en instalaciones industriales [on line]. Barcelona: Edicions UPC, 1999 [Consultation: 22/05/2020]. Available on: http://hdl.handle.net/2099.3/36154. ISBN 9701502930.
- Crowl, Daniel A ; Joseph F. Louvar. Chemical process safety : fundamentals with applications. 3rd ed. Englewood Cliffs: Prentice-Hall, 2011. ISBN 9780132782838.
- Mannan, Sam. Lees' Loss prevention in the process industries : hazard identification, assessment and control. 4th ed. Oxford: Elsevier, cop. 2012. ISBN 9780123971890.
- Santamaría Ramiro, J. M. ; Braña Aisa, P. A. Análisis y reducción de riesgos en la industria química. 2ª ed. Madrid: Mapfre, 1998. ISBN 8471008599.
- Laurent, André. Sécurité des procédés chimiques : connaissances de base et méthodes d'analyse de risques. 2e. París: Lavoisier-Tec & Doc, 2011. ISBN 9782743013967.
- Guidelines for evaluating the characteristics of vapor cloud explosions, flash fires and BLEVEs. New York: Center for Chemical Process Safety of the American Institute of Chemical Engineers, cop. 1994. ISBN 9780470935101.
- Amyotte, Paul. An Introduction to dust explosions : understanding the myths and realities of dust explosions for a safer workplace. Amsterdam: Butterworth-Heinemann, 2013. ISBN 9780123970077.

RESOURCES

Other resources:
Power points and additional material given by the professors.