

## Course guide

### 240EQ031 - 240EQ031 - Risk and Safety

Last modified: 14/06/2023

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

**Degree:** **Academic year:** 2023 **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 should 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 facility 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. Methodologies 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 out 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 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:

- 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.
- 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., Vilchez, 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.

## RESOURCES

---

### Other resources:

Power points and additional material given by the professors.