240EQ031 - Risk and Safety

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2018
Degree: MASTER’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
MASTER’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
ECTS credits: 6  Teaching languages: Catalan, English

Teaching staff

Coordinator: ELSA PASTOR FERRER
Others: Casal Fabrega, Joaquim

Opening hours

Timetable: The one published in the Atenea website or set up an appointment with the professor.

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.

General:
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

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time</strong>: 150h</td>
<td>54h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>96h</td>
</tr>
<tr>
<td></td>
<td>36.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
1. 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.
II. Modelling of major accidents

**Learning time:** 75h 12m
- Theory classes: 16h
- Practical classes: 11h 12m
- Self study: 48h

**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
   - Atmospheric variables
   - Models of dispersion
   - Study of the cases

9. Runaway reactions

10. Vulnerability
    - Vulnerability of people
    - Vulnerability of devices

III. Methodologies for the risk analysis

**Learning time:** 29h 48m
- Theory classes: 6h 30m
- Practical classes: 4h 18m
- Self study: 19h

**Description:**
10. Environmental risk
    - Different aspects
    - Calculation method

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

12. Security reports
# Planning of activities

## 1. Resolution of Exercises

**Description:**
Resolution of exercises in class

**Support materials:**
Problem statement, data

**Descriptions of the assignments due and their relation to the assessment:**
No

**Specific objectives:**
Application of the theory concepts

## 2. Analysis of Real Cases

**Description:**
Analysis of cases

**Support materials:**
Information about the accident

**Descriptions of the assignments due and their relation to the assessment:**
In some cases

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

## 3. Tests

**Description:**
Carry our exercises in class

**Support materials:**
Bibliographic material

**Descriptions of the assignments due and their relation to the assessment:**
Yes

**Specific objectives:**
Evaluation

## 4. Exams

**Description:**
A partial and a final exam

**Support materials:**
Bibliographic material

**Descriptions of the assignments due and their relation to the assessment:**
Yes
**Specific objectives:**

**Evaluation**

---

**Qualification 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)

---

**Regulations for carrying out activities**

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

---

**Bibliography**

**Basic:**


**Others resources:**

- Power points and additional material given by the professors.