295110 - 2951025 - Risk Analysis

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2018
Degree:
ECTS credits: 6  Teaching languages: English

Teaching staff
Coordinator: Pastor Ferrer, Elsa
Others: Planas Cuchi, Eulalia

Prior skills
Programming, probabilistic calculus

Teaching methodology
- Regular classes
- Hands-on workshops
- Project based learning
- Case studies
- Seminars

Learning objectives of the subject
After this course the students should be able to model reliability, availability and maintainability of complex systems, to apply risk identification techniques, to evaluate consequences of accidents, to understand and quantify the concept of risk, to understand human implications in risk management and to demonstrate knowledge of emergency management procedures.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>34h</th>
<th>22.67%</th>
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<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<td></td>
<td>Hours small group:</td>
<td>20h</td>
<td>13.33%</td>
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<td>Guided activities:</td>
<td>0h</td>
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<td>Self study:</td>
<td>96h</td>
<td>64.00%</td>
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## Content

### General Introduction to risk management

**Learning time:** 4h  
Theory classes: 4h

**Description:**
- Definition of risk  
- Risk acceptance criteria  
- Fundamental concepts of risk assessment and management  
- Risk analysis and decision support

**Specific objectives:**
To understand the concept of risk. To have a clear picture of the different activities involved in risk assessment and management. To understand the implications of risk analysis in decision support processes.

### Reliability, availability and maintainability (RAM)

**Learning time:** 16h  
Theory classes: 8h  
Laboratory classes: 8h

**Description:**
- Fundamental concepts  
- Classical hypothesis testing and modelling  
- Bayesian data analysis

**Related activities:**
- Laboratory session 1: classical hypothesis testing and modelling I (data modelling)  
- Laboratory session 2: classical hypothesis testing and modelling II (hypothesis testing and parameter estimation)  
- Laboratory session 3: Bayesian data analysis I (Markov Chain Montecarlo Methods)  
- Laboratory session 4: Bayesian data analysis II (Genetic algorithms)

**Specific objectives:**
To understand the concepts of systems reliability, availability and maintainability. To model RAM by classical and Bayesian approaches.
### Hazardous materials

**Description:**
- Physical hazards
- Health hazards
- Environmental hazards
- Classification and labelling

**Related activities:**
- Laboratory session 5: Case studies - Identification of hazmats in industrial systems
- Seminar 1: Hazmats handling challenges in energy-efficient technologies

**Specific objectives:**
To identify hazardous materials. To understand hazmats procedures for registration, classification, handling and labelling.

**Learning time:** 6h
- Theory classes: 4h
- Laboratory classes: 2h

### Quantitative risk analysis

**Description:**
- Overview of QRA techniques
- Hazards identification
- Major accidents modelling
- Functional safety

**Related activities:**
- Laboratory session 6: Hazard identification techniques (I)
- Laboratory session 7: Hazard identification techniques (II)
- Laboratory session 8: QRA of complex systems
- Seminar 2: Risk analysis in smart factories

**Specific objectives:**
To apply risk identification techniques. To quantify risk of complex systems. To perform LOPA analysis.

**Learning time:** 18h
- Theory classes: 12h
- Laboratory classes: 6h
Prevention and protection systems

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<tr>
<th>Learning time: 18h</th>
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<tr>
<td>Theory classes: 12h</td>
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<tr>
<td>Laboratory classes: 6h</td>
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Description:
- Safety barriers identification
- Prevention measures
- Protection and mitigation

Related activities:
Laboratory session 9: Real case accidents: analysis and safety performance
Seminar 3: Fire protection industry

Specific objectives:
To know the different safety barriers (preventive and protective) in industrial environments

Qualification system
Partial exam 30%
Final exam 30%
Projects 40%

Regulations for carrying out activities
Exams are all mandatory and all the documentation of the subject is allowed to be used during the exams. All evaluation elements are mandatory

Bibliography

Basic: