240EQ212 - Fundamentals of Combustion and Fire Dynamics

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 Optional)
MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 4.5  Teaching languages: Catalan

Teaching staff
Coordinator: EULALIA PLANAS CUCHI
Others: EULALIA PLANAS CUCHI - ELSA PASTOR FERRER

Opening hours
Timetable: Request your attention time directly to the professor via e-mail

Prior skills
Fundamentals of chemistry, thermodynamics, mass energy and momentum transfer, ordinary differential equations, numerical calculation.

Requirements
To have completed the courses relevant to the matters mentioned in the prior skills.

Degree competences to which the subject contributes

Specific:
3. Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience, and practice, critical reasoning to establish economically viable solutions to technical problems.

4. Conceptualize engineering models; apply innovative methods in problem solving and applications suitable for the design, simulation, optimization and control of processes and systems.

5. Design, build and implement methods, processes and equipment for the supply and management of waste solids, liquids and gases in industries, capable of assessing their impacts and risks.

General:
1. Ability to apply the scientific method and the principles of engineering and economics, to formulate and solve complex problems in processes, equipment, facilities and services, in which the material changes its composition, state or energy content, characteristic of chemical industry and other related sectors which include the pharmaceutical, biotechnology, materials, energy, food or environmental.

2. Integrate knowledge and handle complexity, making judgments and decisions, from incomplete or limited information, including reflections on the social and ethical responsibilities of professional practice.

Teaching methodology
Lectures of theory and problems, participatory problem seminars, work on case studies, seminars

Learning objectives of the subject
The course aims to provide students with the knowledge to interpret and analyze the problems related to fires. At the end of the course the student should be able to:

OE1. Apply the basic laws governing the phenomenon of combustion and fire
OE2. Using mathematical models to identify and characterize the different types of fires
OE3. Using at basic level tools and software to simulate fire behaviour
OE4. List the various fire protection systems
OE5. Describe the basics of fire investigation

<table>
<thead>
<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 112h 30m</td>
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<tr>
<td>Hours large group: 40h 30m 36.00%</td>
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<tr>
<td>Hours medium group: 0h 0.00%</td>
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<tr>
<td>Hours small group: 0h 0.00%</td>
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<tr>
<td>Guided activities: 0h 0.00%</td>
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<tr>
<td>Self study: 72h 64.00%</td>
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</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>INTRODUCTION. FUNDAMENTAL ASPECTS OF COMBUSTION</th>
<th>Learning time: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study: 16h</td>
</tr>
<tr>
<td>Theory classes. Classes of problems. Self-learning. Assessment activities A1</td>
<td><strong>Specific objectives:</strong></td>
</tr>
<tr>
<td>OE1</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>FIRE DYNAMICS</th>
<th>Learning time: 32h</th>
</tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study: 21h</td>
</tr>
<tr>
<td>Theory classes. Classes of problems. Self-learning. Assessment activities A1</td>
<td><strong>Specific objectives:</strong></td>
</tr>
<tr>
<td>OE2</td>
<td></td>
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</tbody>
</table>
## FIRE MODELLING

**Learning time:** 40h  
Theory classes: 9h  
Practical classes: 8h  
Self study: 23h

### Description:

### Related activities:

### Specific objectives:
OE3

## FIRE PROTECTION

**Learning time:** 8h 30m  
Theory classes: 1h 30m  
Practical classes: 1h  
Self study: 6h

### Description:
Introduction to fire protection. Basic description of the different methods of passive and active protection. Reference to regulations

### Related activities:

### Specific objectives:
OE4

## FIRE INVESTIGATION

**Learning time:** 8h  
Theory classes: 1h  
Practical classes: 1h  
Self study: 6h

### Description:
Methods for carrying out the investigation of a fire. Sources of ignition. Traces of a fire. Professions involved.

### Related activities:

### Specific objectives:
OE5
### Planning of activities

| A1-RESOLUTION OF EXERCISES | Hours: 36h  
Self study: 36h |
<table>
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<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Deliver one or different exercises to be solved regularly and individually at home</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Statement of the exercise, notes from class, slides and bibliography of reference</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Detailed resolution of the exercise</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>OE1, OE2, OE3, OE4, OE5</td>
</tr>
</tbody>
</table>

| A2-PRACTICES | Hours: 2h 30m  
Laboratory classes: 2h 30m |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Realization of the practices in the lab or in a computer lab</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Guideline of the practice. Notes from class. Slides. Example solved. Needed program</td>
</tr>
</tbody>
</table>
| **Descriptions of the assignments due and their relation to the assessment:** | Previous report before carrying out the practice.  
Report with the resolution of the problem proposed in the practice |
| **Specific objectives:** | OE1, OE3 |

| A3-SIMULATION OF A CASE WITH FDS | Hours: 10h  
Self study: 10h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Resolution in group and with the help of the FDS program in a case set</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Statement of the case to be solved. Notes from class. Slides. FDS program</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Report with a pre-defined formal structure in which the resolution of the case is shown and analyse the results obtained</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>OE3</td>
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| A4-RESOLUTION IN A PRACTICAL CASE | Hours: 10h  
Self study: 10h |
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**Self study:** 36h  
**Laboratory classes:** 2h 30m  
**Self study:** 10h
Description:
Resolution in group of a set case related to the investigation of a real fire

Support materials:
Statement of the case to be solved. Notes from class. Slides

Descriptions of the assignments due and their relation to the assessment:
Report with a formal pre-defined structure in which the resolution of the case is showned and the results obtained are analysed

Specific objectives:
OE5

Qualification system

Final Mark:

\[ FM = 0.5 \cdot \text{NEF} + 0.2 \cdot \text{NEP} + 0.1 \cdot \text{NAC} + 0.1 \cdot \text{NT} + 0.1 \cdot \text{NP} \]

Where,
NEF: Final examination mark
NEP: Partial examination mark
NAC: Average mark of the problems delivered
NT: Average mark of the team-working job of solving a case
NP: Mark of the practicals

Regulations for carrying out activities

Tests can be made using all available bibliographic material: lecture notes, reference books, collection of problems, etc.

Bibliography