240618 - Fundamentals of Nuclear Engineering

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2018
Degree: BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 3
Teaching languages: English

Teaching staff
Coordinator: Sempau Roma, Josep

Opening hours
Timetable: To arrange by e-mail

Degree competences to which the subject contributes

Transversal:
1. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
2. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

Teaching methodology
Theory expositive sessions
Participative theory sessions
Problem solving sessions

Learning objectives of the subject

- Define radioactivity, the main features of common radioactive processes and explain some of the nuclear reactions of interest to nuclear engineering.
- Identify and explain the effects of the passage of ionizing radiation through matter.
- Enumerate and describe the methods used to detect ionizing radiation.
- Identify some scientific, industrial and medical applications of nuclear and ionizing radiation engineering.
- Enumerate the main features of a nuclear reactor.
- Describe the steps of the nuclear fuel cycle, the concepts underlying waste management and the environmental impact of nuclear facilities.
Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>30h</td>
<td>40.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>45h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>

Content

**Topic 1: Physical principles of the use of nuclear energy**

**Learning time:** 15h
- Theory classes: 6h
- Self study: 9h

**Description:**
1. Historical background
2. Nuclear structure and radioactivity
3. Nuclear reactions; fission chain reaction
4. Interaction of ionizing radiation with matter
5. Radiation detection

**Topic 2: Applications**

**Learning time:** 50h
- Theory classes: 20h
- Self study: 30h

**Description:**
6. Overview of scientific, industrial and medical applications
7. Nuclear reactors and nuclear energy
8. Nuclear fuel cycle and waste management

Qualification system

The assessment of the learning process is based on the following activities:
1. A final exam consisting of a written test, with both theoretical and practical questions (E).
2. A set of exercises and reports to be delivered in written form along the extent of the course (R).

There will be no second-chance exams or tests.

Final Mark, \( FM = 0.5 \times E + 0.5 \times R \)
Bibliography

Basic:
