Course guide  
**240618 - 240618 - Fundamentals of Nuclear Engineering**

**Unit in charge:** Barcelona School of Industrial Engineering  
**Teaching unit:** 748 - FIS - Department of Physics.

**Degree:** BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

**Academic year:** 2023  
**ECTS Credits:** 3.0  
**Languages:** English

**LECTURER**

**Coordinating lecturer:** de Blas del Hoyo, Alfredo  
**Others:** Futatani, Shimpei

**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**

Participative theory sessions  
Problem solving sessions

During the autumn semester of the 2020-2021 academic year, and as a consequence of the health crisis due to COVID10, the classes will probably be given by using telematic tools.

**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.
- Describe the main features and systems of a nuclear fission reactor.
- Describe the steps of the nuclear fuel cycle, the concepts underlying waste management and the environmental impact of nuclear facilities.
- Describe the operation and systems of a nuclear fusion reactor.

**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>45,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>30,0</td>
<td>40.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 75 h
CONTENTS

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

**Description:**
This module is structured in the following topics:
1. Introduction. Historical background
2. Nuclear structure and radioactivity
3. Nuclear reactions; fission chain reaction, fusion reaction.
4. Interaction of ionizing radiation with matter

Each topic will last approximately one class.

**Related activities:**
In each class/topic:
- An individual questionnaire on the most important concepts of the topic.
- Group exercises

**Full-or-part-time:** 19h
Practical classes: 10h
Self study : 9h

**Topic 2: Applications. Nuclear Engineering.**

**Description:**
5. Radioactive sources.
7. Radiological protection.
8. Industrial applications. Gauges based on radioactivity.
10. Nuclear power plants.
11. Nuclear fusion reactors.

**Related activities:**
In each class/topic:
- An individual questionnaire on the most important concepts of the topic.
- Group exercises

**Full-or-part-time:** 43h 20m
Theory classes: 20h
Self study : 23h 20m

**GRADING 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). This exam is divided in two part: Fundamentals of nuclear physics (E1) and applications (E2)
2. A set of exercises and reports to be delivered in written form along the extent of the course (R).
3. A project to be delivered at the end of the course (P).

Final Mark, $FM = 0.2 \times E1 + 0.3 \times E2 + 0.2 \times R + 0.3 \times P$

During the autumn semester of the 2020-2021 academic year, and as a consequence of the health crisis due to COVID10, the grading method will be the same as exposed above. No changes are expected in the subject.
BIBLIOGRAPHY

Basic: