Course guide
240618 - 240618 - Fundamentals of Nuclear Engineering

Last modified: 16/05/2023

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.
- Decribe the operaction and systems of a nuclear fusion reactor.

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours medium group	30,0	40.00

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.
6. Radiation measurement. Nuclear instrumentation.
7. Radiological protection.
8. Industrial applications. Gauges based on radioctivity.
9. Nuclear fusion reactors.
10. Nuclear power plants.
11. Nuclear fusion reactors.
12. Environmental radiation.

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 * E1 + 0.3 * E2 + 0.2 * R + 0.3 *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:
- Ortega Aramburu, X.; Jorba Bisbal, J., eds. Las radiaciones ionizantes : utilización y riesgos [on line]. 2a ed. Barcelona: Edicions UPC, 1996-2001 [Consultation: 04/04/2023]. Available on: https://upcommons.upc.edu/handle/2099.3/36551. ISBN 8483011700.
- Glasstone, Samuel; Sesonske, Alexander. Nuclear reactor engineering. 4th ed. Malabar, Florida: Krieger Pub. Co, 1994. ISBN 0412985314.