Universidad Zaragoza

Year : 2020/21

26951 - Nuclear Physics and Technology

Syllabus Information

Academic Year: 2020/21
Subject: 26951 - Nuclear Physics and Technology
Faculty / School: 100 - Facultad de Ciencias
Degree: 447 - Degree in Physics
ECTS: 5.0
Year: 3
Semester: Second semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

To know theoretical and practically the main applications of nuclear physics and technology.

1.2.Context and importance of this course in the degree

Radionuclides and nuclear technology are widely used in fields like medicine, industry, agriculture, electrical power production, research, etc.

1.3.Recommendations to take this course

It is advised to have passed Nuclear and Particle Physics.

2.Learning goals

2.1.Competences

1 Understand the use of radionuclides and ionizing radiation in medicine, industry and research

2 Understand the basic principles, consequences and applications of nuclear fission and fusion for electrical power production

2.2.Learning goals

1 The student knows radiotherapy and diagnosis techniques, their applications, advantages and disadvantages

2 The student is able to design simple devices for industrial applications of radiations

3 The student knows simple models that describe the operation of a nuclear reactor

4 The student knows different types of nuclear reactors and their main characteristics

5 The student is able to identify risks of nuclear reactor operation and radioactive waste management

6 The student knows the physics of a thermonuclear fusion reactor and the status and prospects for electrical power production

2.3.Importance of learning goals

1 Understand the use of radionuclides and ionizing radiation in medicine, industry and research

2 Understand the basic principles, consequences and applications of nuclear fission and fusion for electrical power production

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

1 The course comprises practice sessions in the laboratory with elaboration of written reports (**L mark**). Reports must be submitted not later than 15 days before the theoretical-practical assessment. The maximum score will be 10 points. A

minimum of 4 points is necessary to pass the course. It contributes to a 25% of the final mark.

2 The course also comprises the elaboration of written reports (**T mark**). Students can, voluntarily, elaborate an additional report about a selected topic of the course. This written report should be defended in an oral presentation in the classroom. The maximum score will be 10 points. It contributes to a 25% of the final mark.

3 A continued evaluation (**C mark**), solving problems and questions during the classes, with a duration previously established, will take into account the autonomous work and study of the students throughout the course. The maximum score will be 10 points. It contributes to a 15% of the final mark.

4 The rest of the evaluation consists of a theoretical-practical assessment in the date established by the Faculty of Sciences (**P mark**). The maximum score will be 10 points. It contributes to, at least, a 35% of the final mark.

The final mark will be the greatest of

N = 0.25 * L + 0.25 * T + 0.15 * C + 0.35 * P

N = 0.25 * L + 0.25 * T + 0.50 * P

N = 0.25 * L + 0.15 * C + 0.60 * P

N = 0.25 * L + 0.75 * P

A minimum of N=5 points is necessary to pass the course.

Passing the course by a single global assessment

The global evaluation consists on:

1 A theoretical-practical assessment in the date established by the Faculty of Sciences (**P mark**). The maximum score will be 10 points. It contributes to a 75% of the final mark.

2 A practical assessment in the laboratory (**L mark**). The maximum score will be 10 points. A minimum of 4 points is necessary to pass the course. It contributes to a 25% of the final mark.

The final mark will be the greatest of

N = 0.25 * L + 0.75 * P

A minimum of N=5 points is necessary to pass the course.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures and practice sessions. Lectures will be used to provide students with the basic knowledge required to face the problem solving and laboratory sessions. Participative problem-solving sessions and laboratory will be conveniently intertwined.

4.2.Learning tasks

The 5 ECTS course includes the following learning tasks:

- Lectures (3.5 ECTS: 35 hours). Lectures will be used to provide students with the basic knowledge required to face the practice sessions and laboratory sessions.
- Practice sessions (1 ETCS: 10 hours). Students solve problems in a participative way.
- Laboratory sessions (0.5 ETCS: 5 hours). Laboratory reports must be submitted not later than 15 days before the theoretical-practical assessment.

4.3.Syllabus

The course will address the following topics:

1. Radionuclides in medicine. Radionuclide production. Nuclear medical imaging. Radiotherapy techniques.
2. Industrial and scientific applications. Tracers. Process control. Sterilization. Radioactive dating and analysing methods.
3. Nuclear fission: neutron interaction with matter, nuclear chain reaction, nuclear fission reactor, nuclear fuel cycle, radioactive waste management.
4. Nuclear fusion: physics in a thermonuclear fusion reactor, plasma confinement, prospects for electrical power production.

4.4.Course planning and calendar

Lectures and practice sessions: 4 sessions / week.

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Sciences website.

4.5.Bibliography and recommended resources