Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Medical and Industrial Applications of Nuclear Physics

1.2. Scientific area acronym

Physics

1.3. Duration

15 weeks

1.4. Total of Working Hours

4.5 hours per week

1.5. Contact hours

15*4.5 = 67.5

1.6. ECTS

6

1.7. Observations

Campo alfanumérico (1.000 carateres).

2. Responsible Academic staff and lecturing load in the curricular unit (enter full name)

Pedro Miguel Martins Ferreira	100%

3. Other academic staff and lecturing load in the curricular unit

Campo alfanumérico (1.000 carateres).	

4. Learning outcomes of the curricular unit

To obtain a basic formation in nuclear physics, in particular in what concerns the treatment of radioactivity and its interaction with mater.

Examine situations dealing with nuclear reactions.

To judge their impact on human beings, understanding the effects of radiations, their dosimetry and safety levels.

Recognizing the foundations of energy production in nuclear fission reactors and in thermonuclear fusion reactors.

5. Syllabus

1 – MATTER ELEMENTARY COMPOSITION

2 – PROPERTIES OF ATOMIC NUCLEI: ISOTOPES, MASSES BINDING ENERGIES

3 – RADIOACTIVITY AND ITS EFFECTS IN MATTER AND LIVING BEINGS

4 – NUCLEAR REACTIONS: ENERGY BUDGET AND CROSS SECTIONS; NUCLEAR FISSION

5 – NUCLEAR FISSION REACTORS: FUEL, MODERATORS, ENERGY PRODUCTION, OPERATION; TYPES OF REACTORS, SAFETY, ECONOMICAL EFFICIENCY, DISMANTLING

6 –NUCLEAR FUSION: REACTOR TYPES, CONFINEMENT, LAWSON'S CRITERIUM

6. Demonstration of the syllabus coherence with the curricular unit's objectives

A basic formation in Nuclear Physics is necessary for a deeper understanding of nuclear energy production – sicne the students of this UC do not have it, the first part of the course will provide them with the basic knowledge to allow them to understand: the calculation of the energy released on a nuclear reaction; the very definition of nuclear reaction; the concept of cross section, crucial to fully understand nuclear fission reactions. once these basic concepts are fully grasped, the students will be ready to understand the functioning of commercial reactors operating right now and analyze them in detail. Simultaneously, the subjects taught will be used to understand the medical applications of radiation, with special emphasis in treatments and diagnoses, and radiological protection.

7. Teaching methodologies (including evaluation)

The relevant theory is complemented with a series of exercises, and during the course practical examples of the subjects taught are discussed, with an emphasis on technological applications. To obtain a passing grade the student must have a final classification above or equal to ten: by undertaking two tests during the term, the classification of which should be larger or equal to 8, the final theory classification being their average; or by undertaking a final exam, on the first or second dates reserved for them. In parallel, the visit to a laboratory of nuclear physics will lead to the elaboration of a report on the experiments performed; and the use of a Monte Carlo simulation code will allow the students to make a computational work applying the concepts they have learned in clinical situations, as well as on aspects of radiological protection matters. Final classification: 70% of the theory classification and 30% of the practical classification.

8. Demonstration of the coherence between the teaching methodologies and the learning outcomes

The formation on nuclear physics allows the students to get a good grasp of the basics of the nuclear fission and an understanding, in qualitative and quantitative terms, the functioning, and differences, of current nuclear reactors. The concepts taught allow the students to understand, and reproduce with calculations, the amount of energy and nuclear residue produced in a nuclear reactor, as well as to simulate with computer codes simple situations of practical interest.

9. Bibliography

Kenneth S. Krane, Introductory Nuclear Physics (Manual) John Wiley & Sons, 1988.

David Bodansky, Nuclear Energy: Principles, Practices, and Prospects, Springer-Verlag New York Inc., 2004.

Raymond Murray, Nuclear Energy: An Introduction to the Concepts, Systems and Applications of Nuclear Processes, Butterworth-Heinemann, 2001.

W.M. Stacey, Nuclear Reactor Physics, John Wiley & Sons, 2001.