

**COURSE DATA****Data Subject**

Code	43073
Name	Radiation dosimetry
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. Period year
2140 - M.D. in Medical Physics	Faculty of Physics	1 First term

Subject-matter

Degree	Subject-matter	Character
2140 - M.D. in Medical Physics	2 - Dosimetry and radiation protection	Obligatory

Coordination

Name	Department
BALLESTER PALLARES, FACUNDO	180 - Atomic, Molecular and Nuclear Physics
VIJANDE ASENJO, JAVIER	180 - Atomic, Molecular and Nuclear Physics

SUMMARY

Radiation dosimetry is the branch of science that attempts to quantitatively relate specific measures made in a radiation field to physical, chemical and / or biological changes that radiation would produce in a target. Radiation dosimetry is essential for quantifying the impact of various biological changes as a function of the amount of radiation received (dose-effect relationships), for comparing different experiments, for monitoring the radiation exposure of individuals, and for surveillance of the environment. This course describes the main concepts upon which radiation dosimetry is based and presents methods for their practical use, and subsequently this content is used in "Radiological Protection in Medicine", "Physical aspects of radiotherapy" and "Imaging systems for medical diagnosis".



PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No existen requisitos previos

OUTCOMES

2140 - M.D. in Medical Physics

- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of their knowledge and judgments.
- Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.
- Students have the learning skills that will allow them to continue studying in a way that will be largely self-directed or autonomous.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students have the knowledge and understanding that provide a basis or an opportunity for originality in developing and/or applying ideas, often within a research context.
- Be able to access to information tools in other areas of knowledge and use them properly.
- Use the different exhibition techniques oral, written, presentations, panels, etc., to communicate the knowledge, proposals and positions.
- Project the knowledge on specific problems and know how to summarize and extract the most relevant arguments and conclusions for their resolution.
- To acquire a critical attitude that allows you to make reasoned judgments and defend them with rigor and tolerance.
- Critically analyze both his/her work and that of the colleagues.
- Acceder a herramientas en el área de Física que puedan ser susceptibles de aplicación a la Medicina y valorar su aplicabilidad e interés.
- Planificar y gestionar la utilización de las técnicas físico-médicas teniendo en cuenta los principios básicos de control de calidad, prevención de riesgos, seguridad y sostenibilidad.



- Seleccionar la instrumentación apropiada para el estudio a realizar y aplicar sus conocimientos para utilizarla de manera correcta.
- Valorar el binomio riesgo-beneficio asociado a las técnicas físicas aplicadas al diagnóstico y la terapia, buscando optimizar el beneficio y minimizar el riesgo.
- Aplicar los modelos físicos de cálculo de dosis.
- Utilizar la tecnología implicada en la producción y posterior detección de las radiaciones ionizantes.

LEARNING OUTCOMES

At the end of the teaching-learning process the student should be able to:

- Knowing the basics of physical dosimetry.
- Manage dosimeters.
- Meet the performance requirements of dosimetry systems.

DESCRIPTION OF CONTENTS

1. Classification of Radiations

- (a) Basic physical quantities and units used in radiation physics
- (b) Types and sources of directly and indirectly ionizing radiations
- (c) Description of ionizing radiation fields

2. Quantities and Units Used for Describing Radiation Fields

- (a) Fluence and fluence rate
- (b) Energy fluence and energy fluence rate
- (c) Monoenergetic and polyenergetic spectra

3. Quantities and Units Used for Describing the Interaction of Ionizing Radiation with Matter

- (a) Terma, kerma, collisional kerma, radiative kerma
- (b) Absorbed dose
- (c) Energy transferred, net energy transferred, energy imparted
- (d) Equivalent dose and quality factor
- (e) Exposure
- (f) Dose equivalent



(g) Recommendations of the ICRU

4. Charged Particle and Radiation Equilibrium

- (a) Radiation equilibrium
- (b) Charged particle equilibrium (CPE)
- (c) Relationships between absorbed dose, collisional kerma, and exposure under CPE
- (d) Conditions that enable CPE or cause its failure
- (e) Transient CPE

5. Radiation dosimetry

- (a) Types and general characteristics of dosimeters
- (b) ICRU definitions of dosimetry quantities and units
- (c) Absolute vs. relative dosimetry techniques
- (d) Interpretation of dosimeter measurements

6. Laboratory work

- Dosimetry by OLS
- Dosimetry by radiochromic films
- Dosimetry by Monte Carlo: Penelope

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	16,00	100
Development of group work	4,00	0
Development of individual work	4,00	0
Study and independent work	30,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	11,00	0
Resolution of case studies	5,00	0
TOTAL	125,00	



TEACHING METHODOLOGY

MD1 - Study material based on textbooks (ebook).

MD2 - Videoconferences to solve doubts about theory topics.

MD3 - A questionnaire with conceptual questions and numerical exercises will be proposed for each of the topics.

MD4 - Videoconferences to resolve doubts of the questionnaires and exercises.

MD5 - Practical laboratory classes. The students will present a small memory with the results of each practice.

MD6 - Videoconferences of experts in the subjects on topical issues in dosimetry. Optional. Not evaluable.

EVALUATION

The evaluation will be made during the development of the subject. During the development of each topic, a questionnaire will be opened that the student will have to solve within a fixed period of time that ends one day after the subject has been closed.

Questionnaires	50
Calculation practice (Magnitudes and Units)	16
Laboratory	34
Total	100

Those students who have not opted for the online evaluation or who have not passed it, may opt for an exam during the period enabled for this purpose, both in the first and in the second call.

REFERENCES

Basic

- P. Andreo, D. T. Burns, Alan E. Nahum, J. Seuntjens and Frank H. Attix, Fundamentals of Ionizing Radiation Dosimetry. John Wiley & Sons. 2017

Additional

- James E. Turner, Atoms, Radiation and Radiation Protection. Wiley-VCH. 2nd edition. 2004.