COURSE DATA

DATA SUBJECT

Code: 43075
Name: Radiation protection in medicine
Cycle: Master's Degree
ECTS Credits: 5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2140 - Master's Degree in Medical Physics	Facultat de Física	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2140 - Master's Degree in Medical Physics	Dosimetry and radiation protection	COMPULSORY

COORDINATION

CIBRIAN ORTIZ DE ANDA ROSA MARIA

DIEZ DOMINGO SERGIO

ABAD MOCHOLI DIEGO

SUMMARY

Radiation protection is a scientific and technical field which generic objective is the protection of the individuals and the environment against harmful effects of exposure to ionizing radiation.

This course describes the main principles of radiation protection in the medical field, both in diagnostic and therapeutic procedures, described in the courses on \"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

COMPETENCES / LEARNING OUTCOMES

2140 - Master's Degree in Medical Physics

Acceder a herramientas en el área de Física que puedan ser susceptibles de aplicación a la Medicina y valorar su aplicabilidad e interés.

Aplicar los modelos físicos de cálculo de dosis.

Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.

Be able to access to information tools in other areas of knowledge and use them properly.

Critically analyze both his/her work and that of the colleagues.

Elaborar una memoria clara y concisa de los resultados de su trabajo y de las conclusiones obtenidas.

Integrar los criterios generales de protección radiológica.

Manejar los detectores de radiación.

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.

Project the knowledge on specific problems and know how to summarize and extract the most relevant arguments and conclusions for their resolution.

Realizar el cálculo de barreras.

Realizar el control de calidad de equipos radiológicos.

Saber redactar y preparar presentaciones para posteriormente exponerlas y defenderlas en público.

Seleccionar la instrumentación apropiada para el estudio a realizar y aplicar sus conocimientos para utilizarla de manera correcta.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both

specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

To acquire a critical attitude that allows you to make reasoned judgments and defend them with rigor and tolerance.

Use the different exhibition techniques oral, written, presentations, panels, etc., to communicate the knowledge, proposals and positions.

Utilizar la tecnología implicada en la producción y posterior detección de las radiaciones ionizantes.

Valorar el binomio riesgo-beneficio asociado a las técnicas físicas aplicadas al diagnóstico y la terapia, buscando optimizar el beneficio y minimizar el riesgo.

DESCRIPTION OF CONTENTS

1. Basic Principles of Radiation Protection

Objectives of radiation protection
Legal basis
Organisms with responsibilities in radiation protection

2. Quantities and units in radiation protection

Dosimetric quantities in radiation protection
Operational quantities
Radiation exposure evaluation

3. Radiation interaction with matter from the radiation protection point of view

Ionizing and non-ionizing radiation
Transfer and deposition of energy
Physical and chemical effects of radiation

Radiation interactions with cells and tissues

4. Biological aspects of radiation protection

Radiation interactions with cells and tissuesStochastic and determinist somatic effects
Genetic effects
Risk estimations

5. The System of radiation protection

Types and categories of exposures
Identification of exposed individuals
Radiation protection principles: Justification, optimization and application of dose limits
Dose constraints and reference levels

6. Operational radiation protection

Fundamental principles of operational RP
- Exposure prevention: prior evaluation, classification and marking of areas, classification of experienced workers, information and training.
- Exposure note: monitoring of the work environment, individual monitoring, recording and reporting of results
- Health surveillance of medical workers
- Protective measures for members of the public
- PR and UTPR services

7. Structural shielding design

Shielding for alpha and beta emitting sources
Shielding for photon sources
Shielding for X-ray installations
Design of radiodiagnostic installations

8. RP in diagnostic

RP regulation
Patients RP
Quality control in diagnostic
Quality assurance program
Equipment quality control program

Most usual radionuclides in Nuclear Medicine
Measure systems

9. Radiological protection in the use of non-encapsulated sources

Most usual radionuclides in Nuclear Medicine
NM Installation design
Operational RP
Quality control in NM

10. Radioactive contamination

Types of contamination
Decontamination of internally or externally contaminated persons.
Decontamination of areas and equipment

11. Radioactive waste management

Radioactive waste classification
Principles of radioactive waste management
Declassification and disposal of radioactive waste
Radiological protection based on the design of the transport package
Radiological protection based on administrative and operational procedures: Signs, labeling of packages, limits of surface contamination

12. Design of structural shields in radiotherapy

Design of radiotherapy installations
Shielding for radiotherapy installations
Mazes
Protection against neutrons

16. Lab work

Quality control of a radiological installation
Calibration of an environment radiation monitor

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00

Total hours	**50,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	25,00
Preparation of lessons	20,00
Preparation for assessment activities	10,00
Resolution of case studies	10,00
Total hours	**75,00**

TEACHING METHODOLOGY

- Theoretical lecture on line.
- Students must provide solutions to a collection of proposed problems.
- Presencial laboratory practices.
- Following the completion of practical work, each student will present a report, and will discuss the results.
- Questionaries

EVALUATION

Attendance at on-site practical sessions is compulsory in order to pass the subject in both the first and second examination sittings.

First and second examination sittings:

- Written exam covering the content developed in the theoretical and practical classes of the subject. 60%
    - Theory exam: 10 multiple-choice questions (2.5 points)
    - Between 2 and 4 short reasoning questions (2.5 points)
    - Problem-solving exam: 2 problems (5 points)
- Assessment of practical reports, problem sets, quizzes, and active participation in theoretical and practical classes. 40%

The minimum mark required in the written exam to average with the other activities (practicals, problem sets, etc.) will be 2.4 out of 6 (4 out of 10).

The minimum overall mark to pass is 5.

Evidence of copying or plagiarism will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the ¿**Action Protocol for fraudulent practices at the University of Valencia**¿ will be applied (ACGUV 123/2020):

https://www.uv.es/sgeneral/Protocols/C83sp.pdf

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REFERENCES

- B. Dörschel, V. Schuricht, J. Steuer, The Physics of Radiation Protection, Nuclear Technology Publishing, 1996

- Jamie V.Trapp and Thomas Kron. An introduction to Radiation Protection in Medicine. (2008)

- ICRP. Publicación 103. The 2007 Recommendations of the International Commission on Radiological Protection. Annals of the ICRP (2007)

- NCRP report No. 147. Structural Shielding design for medical X-ray imaging facilities. (2004)

- NCRP report No. 151. Structural shielding design and evaluation for megavoltage X- and gamma-ray radiotherapy facilities. (2005)

- IAEA Safety Reports Series No. 47. Radiation Protection in the Design of Radiotherapy Facilities. (2006)