VNIVERSITAT DE VALÈNCIA

Course Guide
43075 Radiation protection in medicine

COURSE DATA

Data Subject	
Code	43075
Name	Radiation protection in medicine
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2022 - 2023

Study (s)

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

Subject-matter

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

Coordination

Name	Department
CIBRIAN ORTIZ DE ANDA, ROSA MARIA	190 - Physiology
DIEZ DOMINGO, SERGIO	190 - Physiology
ROSELLO FERRANDO, JUAN VICENTE	165 - Philosophy

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

No existen requisitios previos

OUTCOMES

2140 - M.D. in Medical Physics

- 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.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- 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.
- Integrar los criterios generales de protección radiológica.
- Realizar el cálculo de barreras.
- Manejar los detectores de radiación.
- Realizar el control de calidad de equipos radiológicos.
- Elaborar una memoria clara y concisa de los resultados de su trabajo y de las conclusiones obtenidas.
- Saber redactar y preparar presentaciones para posteriormente exponerlas y defenderlas en público.

LEARNING OUTCOMES

At the end of the teaching-learning process, the student must be able to:· Know the fundamental principles of radiation protection.· Know the magnitudes and units of interest in radiation protection.· Properly classify exposed workers and work areas.· Know the biological effects of ionizing radiation.· Design a radioactive or radiological installation, minimizing the risks to which its operators may be exposed.· Know the administrative requirements for the authorization of a radioactive or radiological installation.· Know the quality controls to be carried out on the installation equipment.· Know the calibration process of environmental radiation detectors.

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

4. Biological aspects of radiation protection

Radiation interactions with cells and tissues
Stochastic 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

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

Most usual radionuclides in Nuclear Medicine
Measure systems
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

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	20,00	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	10,00	0
Resolution of case studies	10,00	0
TOTAL	**125,00**	

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

· There will be a final theory and problems exam.· The theory exam will consist of multiple choice and development questions.· The final grade of the signature will be calculated as follows:

Resolution of theoretical content questionnaires	10
Problem resolution	15
Practice memories	25

Theory test and problems	50
TOTAL	**100**

To calculate the final weighted grade, it will be necessary that in each of the first four sections at least 40% of the assigned weight has been obtained, and in the total at least 50% have been obtained.

REFERENCES

Basic

- 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)

Additional

- 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)