COURSE DATA

DATA SUBJECT

Code: 43078
Name: Physical aspects of radiotherapy
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	The physics of diagnosis and therapy	COMPULSORY

COORDINATION

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SUMMARY

This subject provides the theoretical bases and the necessary practices to have an overview of radiotherapy, very suitable when choosing to dedicate yourself professionally to this activity and learn the specialty. We try to give a very broad vision with the latest advances in this medical field. It allows us to understand the relationship between the physical aspects of radiation oncologist treatments and their relationship with the success or failure of the fight against cancer. Radiation therapy is the clinical process that uses ionizing radiation to treat cancer. It is also used, and very selectively, in some benign lesion treatments. Radiation emitting procedures and sources are used in a very special way and in accordance with the objective of the treatment. These sources are used alone or in combination with other treatment modalities (use of various radiotherapy techniques, surgery, chemotherapy, etc.). The objective of this subject is to offer a global vision of these modalities and their role in the management of cancer treatment.

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.

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.

Manejar las técnicas básicas de control de calidad de las diferentes modalidades de obtención de imágenes.

Manejar los métodos matemáticos de procesamiento de señales para la obtención de las diferentes modalidades de imágenes.

Medir campos electromagnéticos en diferentes ambientes.

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.

Relacionar el fundamento físico con cada técnica de adquisición de imágenes y distinguir las peculiaridades de la información diagnóstica que permite obtener cada modalidad.

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.

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

0. Introduction to the subject

1. Cancer epidemiology and clinic

1.1 Situation of cancer in Spain
1.2 Risk Factors
1.3 Principles of clinical oncology

2. Radiobiology

Tumor control and normal tissue tolerance (therapeutic index)
Repair, fractionation, organ tolerances
Mathematical aspects of survival curves

3. Photon beams

3.1 Physical characteristics of photon beams.
3.2 Treatment parameters in photon beams.
3.3 Profiles of treatment beams.
3.4 Isodose curves.
3.5 Corrections in patients.
3.6 Calculation of monitor units.

4.
Electron beams

4.1 Physical characteristics of electron beams.
4.2 Treatment parameters in electron beams.
4.3 Profiles of treatment beams.
4.4 Isodose curves.
4.5 Corrections in patients.
4.6 Calculation of monitor units.

5.
Beam calibration

5.1 Doismetric protocols. TRS-398 protocol.
5.2 Determination of absorbed dose using ionization chambers.
5.3 Corrections for magnitudes of influence.
5.4 Correction factor for beam quality.
5.5 Measurement of the reference dose. Practical examples.

6. Volumetric imaging systems and registration in 3D space

7. Special techniques

7.1 Radiosurgery
7.2 Total Body Irradiation (TBI)

8. Interrelation Radiophysics and Radiotherapy Oncology: Role of each specialist in treatment planning

8.1 Quality Indicators in Radiotherapy
8.2 Importance of Radiotherapy currently in the treatment of Cancer

10. Nuevos haces para nuevos tratamientos

1. Exercises on photon and electron beams
2. Neutron dosimetry

11. Practical classes

1. Exercises on photon and electron beams
3. Design of a 3D Radiotherapy treatment with PLUNC
4 3D Printting

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

MD1.- Theoretical classes will be in the form of a master class recorded and viewed online.

MD2.- Practical laboratory classes will be held in hospitals

MD3.- Videoconferences of kinds of problems.

MD4.- Videoconferences of experts in the subjects.

MD5.- Videoconferences to resolve doubts about the issues

After the practicals each student will present a memory of the same

EVALUATION

Attendance to on-site practical sessions is mandatory in order to pass the subject in both the first and second exam sittings.

First and second exam sittings:

- Written exam covering the content developed in the theoretical and practical classes of the subject. 60%
  Test-type exam.

- Assessment of practical reports, problem-solving activities and active participation in theoretical and practical classes. 40%

The minimum grade for the written exam in order to average with the practical component is 2 out of 6.

The minimum grade to pass the subject 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

REFERENCES

- Faiz M. Khan, The Physics of Radiation Therapy, Fouth edition, Wolkers Kluwer-Lippincott Williams $ Wilkins, 2010

- Harold E. Johns y John R. Cunningham, The Physics of Radiology. 4ª edición. Charles C. Thomas Publisher. 1983.

- E.J.N. Wilson An Introduction to Particle Accelerators (Oxford University Press, 2001)

- Harold E. Johns y John R. Cunningham, The Physics of Radiology. 4ª edición. Charles C. Thomas Publisher. 1983.