

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

<b>Code</b>	43077
<b>Name</b>	Imaging systems for medical diagnosis
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	5.0
<b>Academic year</b>	2020 - 2021

**Study (s)**

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

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2140 - M.D. in Medical Physics	3 - The physics of diagnosis and therapy	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
CIBRIAN ORTIZ DE ANDA, ROSA MARIA	190 - Physiology

**SUMMARY**

The physical principles and technological developments associated with the main medical imaging techniques are presented. The agenda is divided between those that use biologically ionizing radiation and those that use non-ionizing radiation. Thus, in the first group, radiographic techniques are studied from conventional radiography, digital radiography, and CT, evaluating the reconstruction algorithms and the doses associated with these imaging techniques. Within this section, Nuclear Medicine imaging techniques are also analyzed, emphasizing PET, as it is one of the techniques with the greatest potential and current development, due to its interest in the functional analysis of the living organism. Techniques that use biologically non-ionizing radiation include thermography, ultrasound techniques, and nuclear magnetic resonance.



## 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 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.
- Manejar los métodos matemáticos de procesamiento de señales para la obtención de las diferentes modalidades de imágenes.
- Relacionar el fundamento físico con cada técnica de adquisición de imágenes y distinguir las peculiaridades de la información diagnóstica que permite obtener cada modalidad.
- Distinguir las diferencias y similitudes de los métodos de procesamiento y análisis de imágenes de ayuda al diagnóstico.
- Manejar las técnicas básicas de control de calidad de las diferentes modalidades de obtención de imágenes.
- Utilizar los aspectos teóricos y prácticos del procesado de señales eléctricas para su uso en señales e imágenes biológicas.
- 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 and develop the physical principles of the main imaging methods in medical diagnosis: conventional X-ray radiology, Digital Radiology, Computerized Axial Tomography, Helicoidal and multi-slice tomography, Ultrasound Imaging, Thermography, Magnetic Resonance Imaging and Images in Nuclear Medicine.
- Understand the technology associated with different imaging techniques.
- Recognize the importance of functional studies in Nuclear Medicine
- Know the mathematical methods that allow to reconstruct images of cuts or 3D images
- Handle the basic and advanced image treatments, and the quality control methods of the different imaging techniques.

## DESCRIPTION OF CONTENTS

1.



2.

3.

4.

5.

6.

7.

#### **8. Practical sessions**

- 1.- Use of ImageJ program
- 2.- Determination of the radiological contrast
- 3.- Numerical exercises of Thermography and US
- 4.- Clinical application of ultrasound: echocardiographic study at the Clinical Hospital.
- 5.- Image in Nuclear Medicine. General Hospital-ASCIREs.
- 6.- Instrumentation in Molecular Image. i3M: institute of instrumentation for molecular imaging (CSIC-UPV)
- 7.- Detectors for medical imaging research. IFIMED
- 8.- Obtaining and evaluating thermographic images Fac. Medicine
- 9.- Visit MICROPET-TAC. UCIM.
- 10.- Practical visit to the NMR. IVO

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Development of group work	4,00	0
Development of individual work	4,00	0
Study and independent work	25,00	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	7,00	0
<b>TOTAL</b>	<b>125,00</b>	

**TEACHING METHODOLOGY**

MD1 - Theoretical classes of master class recorded and visualized via on-line.

MD2 - Laboratory practical classes. MD3 - Videoconferences of problem classes.

MD4 - Videoconferences from subject experts.

MD5 - Videoconferences to resolve doubts about the issues

**EVALUATION**

- Written exam on the contents developed in the theoretical and practical classes of the subject. 60%
- Evaluation of written memories of practices and problems 40%

**REFERENCES****Basic**

- Scientific Basis of Medical Imaging. Edited by P.N.T.Wells. Ed. Longman Group Limited 1982





## **ADDENDUM COVID-19**

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

### **1. Contents**

The contents initially collected in the teaching guide are maintained.

### **2. Volume of work and temporary planning of teaching**

The weight of the different activities that add the hours of dedication in ECTS credits marked in the original teaching guide is maintained.

Scheduled sessions are held on the same dates and times with the same duration

### **3. Teaching methodology**

The Master is blended so he already presented these methodologies in the online part:

Upload of materials to the virtual classroom

Proposal of activities for virtual classroom

Synchronous and asynchronous BBC videoconference for topics, problem solving and exercises

Overlaid transparencies

Forum in Virtual Classroom and debates in the forum

Tutoring by videoconference at the request of the students

These methodologies have now also been applied to practices along with:

Videos recorded in the laboratory (practical laboratory classes)

Works with simulators or calculation packages (practical laboratory classes)

### **4. Evaluation**

Exam through the questionnaire in the virtual classroom of 25 multiple choice test questions (4 possible answers and only one correct), on the contents developed in the theoretical and practical classes of the subject. 60%

Evaluation of memories of practices and problems 40%

### **5. Bibliography**



Students have been provided with complementary information from the beginning to the topics developed.

