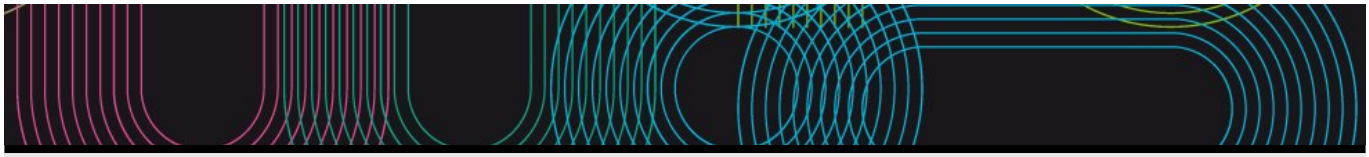

IDENTIFYING DATA				
(*)Sistemas de diagnóstico e terapia				
Subject	(*)Sistemas de diagnóstico e terapia			
Code	V04M192V01104			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Quintáns Graña, Camilo Pastoriza Santos, Vicente			
Lecturers	Aymerich López, María Domínguez Prado, Inés López Medina, Antonio Otero García, María Milagros Pastoriza Santos, Vicente Quintáns Graña, Camilo			
E-mail	quintans@uvigo.es vpastoriza@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The main purpose of this subject is that the student acquires the knowledge about the physical foundations and the technologies used in the medical equipment that integrate the systems of diagnosis and therapy used in the hospital setting. The subject matter is completed with an introduction to the protection, quality and applicable legislation. These contents are complemented and reinforced with the realization of practices oriented to the study of the operation and specifications of the equipment in the services existing in the hospitals participating in the Master's degree.			

Training and Learning Results	
Code	
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B5	Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	Capacity for handling specifications, regulations and mandatory standards.
C4	Knowledge and ability to design and analyze systems, sensors and techniques for diagnosis, therapy and monitoring.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
To know and understand the physical principles of operation of the medical equipment that make up the diagnosis and therapy used in the hospital setting.	B3 B5 C4
To know and understand the operating principles of the main medical equipment used in the hospital environment.	A3 B3 C4

Knowledge to supervise the use and maintenance of medical equipment.	A3 B3 B5 B6 C4
Capability to analyze the management of facilities associated with medical equipment and apply the knowledge acquired for its improvement.	A3 B5 B6 C4
To know the fundamentals for working in multidisciplinary teams typical of biomedical engineering	B3 C4

Contents	
Topic	
Topic 1: Introduction.	General description of the subject. Introduction to diagnostic techniques and therapy.
Topic 2: Physical fundamentals of the diagnostic and therapy equipment.	Electromagnetic waves. Interaction of the electromagnetic radiation with matter. Radioactive transitions. Nuclear structure. Nuclear processes.
Topic 3: Technologies for diagnostics with X-rays.	The X-ray apparatus. Generation of X-rays. Emission of X-rays. X-ray interaction with matter. Detection and formation of image. Intensifying screens, beam restrictor devices and grid.
Topic 4: Characterization and operation of computed tomography equipment.	Introduction. Tomographic image. Conventional, helical and multislice computed tomography. Components. Diagnostic and therapeutic uses. Safety. Representation of the image. Image quality.
Topic 5: Characterization and operation of magnetic resonance equipment	Introduction. Behavior of nuclear spin in a magnetic field. Generation of the magnetic resonance signal. Examination room. Open and closed resonance equipment. Emitters and receptors. Control console. Diagnostic and therapeutic uses. Security. Signal capture: Fourier transform, K-space and data matrix. Repeat time, echo time, inversion time. Classic acquisition sequences: spin-echo, and gradient echo. Reconstruction in 2D and 3D. Artifacts in magnetic resonance. emerging techniques.
Topic 6: Technologies for Nuclear Medicine Diagnostics.	Introduction. Radiopharmaceuticals for imaging diagnostics. Techniques for the production of radiopharmaceuticals. Particle accelerator. Obtaining the flat image. The gamma camera. Positron emission tomography (PET, SPECT).
Topic 7: Technologies for radiotherapy.	Introduction. Types of radiotherapies. Brachytherapy. External beam radiotherapy. Electron beam. X-ray photon beam. The linear accelerator. Proton therapy.
Subject 8: Protection, quality and legislation.	Basic safety standards for protection against exposure to ionizing radiation. Quality criteria in radiotherapy. Safety concepts in nuclear installations. Regulations on medical uses of X-rays. Justification for the use of ionizing radiation in medicine. Quality criteria in radiodiagnostics.
Practices.	Practice 1: Radiology. Practice 2: Nuclear Medicine. Practice 3: Radiotherapy.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	13	13	26
Case studies	4	8	12

Seminars	2	4	6
Previous studies	0	12	12
Laboratory practical	12	0	12
Objective questions exam	0.5	6.5	7
Problem and/or exercise solving	0.5	7	7.5
Report of practices, practicum and external practices	0	18	18
Presentation	2	6	8
Systematic observation	1	1	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	Activities directed to take contact and gather information on the students, as well as to present the matter.
Lecturing	Exposition by the lecturer of the contents on the matter object of study, theoretical bases and/or guidelines of a work, exercise that the/the student has to develop. The the skills to be worked on are: A3, B3, B5, B6 and C4.
Case studies	Analysis of a fact, problem or real event with the purpose to know it, interpret it, resolve it, generate hypothesis, contrast data, to reason, complete knowledge, diagnose it and train alternative procedures for solution. The skills to be worked on are: A3, B3, B5, B6 and C4.
Seminars	Activity focused on the work on a specific topic, that allows to deepen or complement the contents of the course. The skills to be worked on are: A3, B3, B5, B6 and C4.
Previous studies	Research, reading and work of documentation, previous to the classes or practical of laboratory, that makes the students of autonomous form. The skills to be worked on are: A3, B3, B5, B6 and C4.
Laboratory practical	Activities of application of the knowledge to concrete situations, and for acquisition of basic skills and procedures, related with the course. These practices will be developed at hospital facilities. The skills to be worked on are: A3, B3, B5, B6 and C4.

Personalized assistance	
Methodologies	**Description**
Introductory activities	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on the organization of the course will be clarified.
Lecturing	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on the lecture contents of the course will be clarified.
Previous studies	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on the previous work to the classes or practical of laboratory will be clarified.
Seminars	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on the concrete topics will be clarified.
Case studies	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on previously presented cases will be clarified.
Laboratory practical	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on laboratory practices will be clarified.
Tests	**Description**
Report of practices, practicum and external practices	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students on the practice reports will be clarified.

Presentation	The students can attend tutoring sessions (individually or in a group). The timetable will be available on the subject's website on Moovi teleteaching portal (https://moovi.uvigo.gal/) at the beginning of the academic semester. Doubts and queries of the students about the presentation preparation will be clarified.

Assessment

	Description	Qualification	Training and Learning Results
Objective questions exam	Exam that evaluate the knowledge that include enclosed questions with different alternative of answer (true/false, multiple election, pairing of elements, etc.) The students select an answer between a number limited of possibilities.	20	A3 B3 B5 B6 C4
Problem and/or exercise solving	Test/exams in which the student has to solve a series of problems and/or exercises in a time/condition established by the lecturers. Of this way, the students has to apply the acquired knowledge.	20	A3 B3 B5 B6 C4
Report of practices, practicum and external practices	Preparation of a report by part of the student in that they reflect the characteristics of the work carried out. The students have to describe the tasks and procedures developed, show the results obtained and/or observations made, as well as the analysis and treatment of data.	35	A3 B3 B5 B6 C4
Presentation	Presentation by part of a group of students of a subject on contents of the subject or of the results of a work, exercise, project, etc. Can make of individual way or in group.	15	
Systematic observation	Attentive perception, rational, scheduled and systematic to describe and register the demonstrations of the behaviour of the students. It is possible to value learnings and actions, and as they carry out valuing the order, precision, the skill, efficiency, the active participation, etc.	10	A3 B3 B5 B6 C4

Other comments on the Evaluation

1. Ordinary exam

1.1 Continuous assessment

According to the guidelines of the degree and the agreements of the academic commission, a continuous assessment learning system will be offered.

The marks are valid only for the current academic year.

The schedule of the different assessment tests will be available at the beginning of each academic semester.

Continuous assessment consists of the following four parts:

1. Practices (35%), which are divided into:

- Development of the practices: realization of the practices of the matter. Missing is only allowed a session for justified reasons and must be recovered in another shift to the extent of the time possibilities. Your grade will be pass or fail.
- Laboratory practices report (35%).

2. Classroom exams (40%), which are roughly divided into:

- Objective tests (20%).
- Questions and exercises (20%).

3. Presentation (15%): The results of the work on a specific topic of the subject will be presented orally.

4. Systematic observation (10%). In addition, the student's participation in carrying out activities proposed for their autonomous work and participation in tutorials will be taken into account.

The final grade, which is scored out of a maximum of 10 points, is the sum of the grades for each part if the following conditions are met:

- Obtain a passing grade in laboratory practices (attendance at least two thirds of the practices).
- Obtain a minimum score of 40% in the practice report, and in the classroom exams.

If any of the above requirements is not met, the final grade will be the sum of the grades of each part, but limited to a maximum score of 4.9 points. Students who have not reached a minimum score of 40% in the evaluation of the report of the practices will have a term to make the appropriate improvements until the official date of the ordinary or extraordinary exam. Students who have not reached a minimum score of 40% in the classroom exams will be able to recover them in the official date of the ordinary or extraordinary exam maintaining the percentages of the continuous assessment.

To pass, students must obtain a total score equal to or greater than 50% of the maximum grade (5 points).

The exams of objective tests and exercises will be divided into two sessions distributed throughout the academic semester. The first exam will be performed in the middle of teaching period (during the hours of a theoretical class) and the second exam will take place on the date of the final exam.

1.2 Global exam

Students who do not opt for continuous assessment will have to take two exams similar to those of continuous assessment (objective test and exercises) and, they will have to make an oral presentation on one of the topics of the subject to choose between two options, if they have not previously requested the faculty to choose the topic. In addition, they must have obtained a pass grade in the laboratory practices.

It is understood that the completion of practices is mandatory regardless of the call to which they are presented.

To pass, you must obtain a minimum of 40% in each part and add a total of at least 5 points.

2. Extraordinary exam

In this call the evaluation will be as in the ordinary exam. It will be necessary to have passed the laboratory practices during the academic year.

3. Ethical commitment

The student is expected to exhibit appropriate ethical behavior. In the case of detecting unethical behavior (cheating, plagiarism, use of unauthorized electronic devices, or others) in any of the works or exams carried out, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Sources of information

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Recommendations