University of Gdańsk

Subject card

Subject name and code	Nuclear Medicine, PG_00207564						
Field of study	Medical Physics						
Date of commencement of studies	October 2027		Academic year of realisation of subject		2027/2028		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		2.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		Wojciech Cytawa				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		0.0		20.0	50
Subject objectives	The objective of this course is to familiarize students with fundamental and advanced nuclear medicine imaging methods, including planar scintigraphy, SPECT, PET, and their hybrid combinations (SPECT/CT, PET/CT, PET/MR). The curriculum aims to provide knowledge on specialized, organ-dedicated imaging techniques and modern detector technologies (e.g., CZT). Furthermore, students will acquire crucial skills in dosimetry and the analysis of post-therapeutic images in radioisotope therapies, with a specific focus on the use of isotopes such as iodine-131, lutetium-177, and actinium-225.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMEDMU2_W06] Knows and understands to an in-depth degree the current directions of development in physics and medical sciences, particularly in the field of medical physics, as well as the fundamental dilemmas of contemporary civilization	Recognizes and describes current trends in nuclear medicine development, such as total-body PET/CT and PET/MR. Distinguishes the clinical benefits resulting from the use of modern detector technologies (e.g., CZT). Identifies fundamental ethical dilemmas related to the growing use of imaging techniques based on ionizing radiation in diagnostics and therapy.	[SW4] test/exam - oral or written
[FIZMEDMU2_W01] Knows and understands in depth selected issues in the field of physics and medicine, the complex relationships between them, and development trends in the exact and natural sciences, health sciences, and others.	Lists and describes key aspects of dosimetry in radioisotope therapy. Recognizes and identifies the main features of post-therapeutic images obtained from isotope therapies (iodine-131, lutetium-177, actinium-225). Classifies organ-dedicated nuclear imaging methods (e.g., mammo PET, cardiac SPECT) and indicates their applications.	[SW4] test/exam - oral or written
[FIZMEDMU2_K04] He is ready to take care of the achievements and traditions of the medical physicist profession by improving his competencies and popularising knowledge.	The student is prepared to: Acknowledge and apply ethical principles and radiation safety standards in the practice of radioisotope diagnostics and therapy. Demonstrate awareness of the need for continuous professional development and knowledge updates in the face of the dynamic evolution of nuclear imaging technology. Appreciate the importance of reliable dissemination of knowledge about the benefits and risks associated with nuclear medicine to the medical community and society. Engage in discussions about the role of a medical physicist within an interdisciplinary diagnostic and therapeutic team. Recognize the role of dosimetry and assume responsibility for optimizing radiation doses in isotope therapies.	[SK4] test/exam - oral or written
[FIZMEDMU2_W04] Knows and understands in depth the theoretical foundations and principles of operation of measurement systems and research, diagnostic and therapeutic equipment specific to the field of physics and medicine.	Lists and defines the fundamental nuclear medicine imaging methods: planar scintigraphy, SPECT, and PET. Describes the structure and operating principles of modern detectors in gamma cameras (e.g., CZT semiconductor detectors). Explains the differences between hybrid imaging systems (SPECT/CT, PET/CT, PET/MR) and their individual components. Characterizes the quality control procedures for nuclear medicine imaging equipment.	[SW4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>Nuclear medicine imaging methods: planar scintigraphy, single-photon emission computed tomography (SPECT), and positron emission tomography (PET). These techniques are also used in hybrid methods by combining them with CT scans, creating SPECT/CT and PET/CT, respectively. Specialized quality control tests.

Modern PET imaging techniques include PET/MR (a fusion of PET with magnetic resonance imaging) and total-body PET/CT (a scanner capable of imaging a patient's entire body simultaneously).

Specialized methods are dedicated to specific organs: mammo PET, a PET scanner designed for breast imaging, and cardiac SPECT, a specialized gamma camera for cardiology. A thyroid gamma camera is also used for imaging the thyroid gland.

Gamma cameras are now being developed with cadmium zinc telluride (CZT) semiconductor detectors. These detectors offer improved spatial and energy resolution, leading to more precise imaging.

Dosimetry aspects are crucial in radioisotope therapy. Post-therapeutic imaging is performed in selected isotope therapies, such as those using iodine-131, lutetium-177, and actinium-225, to assess treatment distribution and effectiveness.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>written exam</td><td>51.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Medycyna nuklearna. Podręcznik dla lekarzy, radiofarmaceutów i fizyków medycznych", red. L. Królicki, A. Hubalewska-Dydejczyk, Kraków 2024
2. Essentials of Nuclear Medicine and Molecular Imaging. Authors: Fred A. Mettler and Milton J. Guiberteau, Brand: Elsevier, 2018.</td></tr>
<tr><td>Supplementary literature</td><td>not applicable</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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