Study program: Master studies Physics

Subject: Essentials of Nuclear Medicine Physics

Status of the course: compulsory

Number of ECTS: 8

Requirement:

Course goal

The main objective of this course is to introduce students to the basics of physical application of radioisotopes in the diagnosis and therapy, as well as the basic principles of the protection of patients and medical staff performing diagnostic and therapeutic procedures in nuclear medicine.

Outcome

-General competences:

Students acquire knowledge of the physical principles of nuclear medicine

- Specific skills:

Students acquire knowledge of: artificial radioisotopes production used in nuclear medicine, development of detectors for measuring radioactivity and devices for scintigraphy, introduction to diagnostic and therapeutic procedures in nuclear medicine, introduce to operation with open sources of ionizing radiation and the principles of radiation protection.

Contents

Theoretical

Physical basis of nuclear medicine: The main types of radioactive decay (α-decay, isobaric and isomeric transitions), metastable state, interaction of α, β and γ radiation with the substance. Detection of radioactivity. Gamma scintillation counter. Pulse analyzer, counter system and visualization.

Radioactive labels in Nuclear Medicine: The discovery of radioactivity. Production of artificial radioisotopes in a nuclear reactor and ciclotron. Isotopes in medicine. Nuclear Medicine as an in vivo application of radio-tracer. Application of the open radioisotope soureces in in vivo and in vitro diagnosis and in therapy. Production of radioactive labeled compounds (the radiopharmaceuticals). Detectors for radioactivity measurement and for scintigraphy. Biodistribution of radiopharmaceuticals and radionuclides in the human body. Scintigraphy, scintigraphy processing. Scintigraphy: apparatus, gamma camera, SPECT (single photon emission computed tomography), PET / CT (positron emission tomography / computed tomography). Analog and digital images, reconstruction algorithms and analysis of the digital data. The use of nuclear-medical methods in in-vivo studies. Practical lessons: Experimental and computational exercises.

Literature

1. Nuclear Medicine Physics, A Handbook for Teachers and Students. Editori: D.L. Bailey J.L. Humm A. Todd-Pokropek A. van Aswegen. International Atomic Energy Agency, 2014. ISBN 978–92–0–143810–2.

Number of active teaching	**Theoretical classes:** 3	**Study research:** 3

Methods of teaching

Lectures (3 times a week, during the term), computing practice (1 time per week during the term), the practical teaching (2 time per week during the term).