COURSE DESCRIPTION CARD - SYLLABUS

Course name
Physical methods in medicine [S1FT2>MFwM]

Course

Field of study
Technical Physics

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic information in physics, the ability to solve elementary problems in physics and engineering based on the possessed knowledge, the ability to obtain information from indicated sources. Ability to work in a group, active attitude when solving problems

Course objective

To familiarize students with physical methods used in modern medicine, and to provide knowledge about the construction of medical equipment used in diagnostics and therapy.

Course-related learning outcomes

Knowledge:
As a result of the conducted classes, the student will be able to:
1. Explain the structure and functions of basic elements of X-ray apparatus and computed tomograph.
2. Present and explain the application of nuclear physics to imaging and therapy of neoplastic changes.

3. Explain the construction and the idea of operation of nuclear magnetic resonance tomography.
4. Present the optical laws used in the construction of medical devices.

Skills:
As a result of the course, the student should demonstrate skills in the following areas (the student will):
1. Be able to describe in detail the process of creating an X-ray and a tomogram and know the functions and technical and construction parameters of X-ray and CT devices used in medicine.
2. Be able to identify radioactive isotopes important for medicine and to discuss in detail the structure and functions of: gamma camera, particle accelerator, cobalt bean and positron emission computed tomomograph.
3. Be able to explain the phenomenon of nuclear magnetic resonance and electron paramagnetic resonance and knows the details of the construction of MR apparatus. They be able to identify the most important medical applications of the magnetic resonance phenomenon.
4. Be able to discuss in detail the construction of optical devices used in medicine: optical microscopes, lasers, spectrometers as well as discuss their medical uses.

Social competences:
As a result of the course, the student will acquire the competences listed below. Completing the course means that students will:
1. Actively engage in solving given problems on their own.
2. Be aware of the social role of a technical university graduate, and especially understand the need to formulate and convey information and opinions on the achievements of physics used in medicine to society.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Form of evaluation Assessment criteria
Pass the course in written form 50.1%-70.0% (3)
70.1%-90.0% (4)
from 90.1% (5)
Assessment of activity during lecture discussions 50.1%-70.0% (3)
70.1%-90.0% (4)
from 90.1% (5)

Programme content

The curriculum covers various medical imaging and diagnostic techniques, including optical and electron microscopy, computed tomography (CT), gamma camera scintigraphy, and positron emission tomography (PET). It also includes studies on X-ray radiation, scintillation and semiconductor detectors, as well as magnetic resonance imaging (MRI) in medical diagnostics. Ultrasonography (USG), thermography, and lasers and their application in medicine are also explored. The principles of operation and use of defibrillators and proton therapy will also be explained.

Course topics

1. Basics of optical and electron microscopy.
2. X-rays (generation, detection, interaction with matter).
3. Basic and contrast X-ray diagnostics.
4. Computed tomography (the principle of operation of a tomograph, image reconstruction, examples of the use of X-ray tomography).
5. Natural and artificial radioactivity.
6. The use of radioisotopes in cancer therapy (brachytherapy, cobalt bomb).
7. Radioisotope diagnostics, characteristics of radioisotopes.
8. Scintillation and semiconductor detectors.
9. Scintigraphy and gamma camera.
10. Examples of scintigraphy of selected organs (thyroid, circulatory system, digestive system).
11. The phenomenon of positron annihilation.
12. Characteristics of positron sources used in medical diagnostics.
13. Basics of positron emission tomography (PET).

14. Examples of the use of PET tomography.
15. Nuclear magnetic resonance (NMR).
16. Nuclear magnetic resonance imaging (MRI).
17. Ultrasonography (USG).
18. Laser and its applications in medicine.
19. Thermovision.
20. Defibrillators.
21. Proton therapy.

Teaching methods

Lecture: multimedia presentation, illustrated with examples.

Bibliography

Basic:
1. Praca zbiorowa pod redakcją A.Z. Hrynkiewicza i E. Rokity. Fizyczne metody badań w biologii, medycynie i ochronie środowiska. PWN Warszawa 1999.
2. Praca zbiorowa pod redakcją A.Z. Hrynkiewicza i E. Rokity. Fizyczne metody diagnostyki medycznej i terapii. PWN Warszawa 2000.
3. Praca zbiorowa pod red. H. Podbielska, A.Sieroń, W.Stręk - Diagnostyka i terapia fotodynamiczna, Wydawnictwo Medyczne Urban &Partner, Wrocław, 2004.
4. Praca zbiorowa pod red. A. Hrynkiewicza - Człowiek i promieniowanie jonizujące, Wydawnictwo Naukowe PWN, Warszawa 2001.

Additional:
Current issues of specialist journals.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00