



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Physical methods in medicine

Course

Field of study

Technical Physics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/6

Profile of study

general academic

Course offered in

Polish

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

Tutorials

Projects/seminars

Other (e.g. online)

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Faculty of Materials Engineering and Technical Physics

Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

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Faculty of Materials Engineering and Technical Physics

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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. [K1_W02, K1_W03]
2. Present and explain the application of nuclear physics to imaging and therapy of neoplastic changes. [K1_W04, K1_W10]
3. Explain the construction and the idea of operation of nuclear magnetic resonance tomography. [K1_W11, K1_W13]
4. Present the optical laws used in the construction of medical devices. [K1_W16]

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. [K1_U02, K1_U03]
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 beam and positron emission computed tomomograph. [K1_U14, K1_U15]
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. [K1_U18]
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. [K1_U22]

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. [K1_K01, K1_K02]
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. [K1_K09]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

| Effect | Form of evaluation | Assessment criteria |
|--------------------|---------------------------------|-----------------------------------|
| W02, W03, W04, W10 | Pass the course in written form | 50.1%-70.0% (3) |
| W11, W13, W16 | | 70.1%-90.0% (4) from 90.1% (5) |



| | | |
|--------------------|---|-----------------|
| U02, U03, U14, U15 | Pass the course in written form | 50.1%-70.0% (3) |
| U18, U22 | | 70.1%-90.0% (4) |
| | | from 90.1% (5) |
| K01, K02, K09 | Assessment of activity during lecture discussions | 50.1%-70.0% (3) |
| | | 70.1%-90.0% (4) |
| | | from 90.1% (5) |

Programme content

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) versus electron paramagnetic resonance (EPR).
16. Nuclear magnetic resonance imaging.
17. Ultrasonography (USG) (mechanical wave propagation in continuous media, Doppler effect, piezoelectric effect).
18. Laser and its applications in medicine.



- 19. Thermovision (thermal radiation and its detection).
- 20. Optical spectroscopy in medical diagnostics.
- 21. The laws of absorption and their application in biological systems.
- 22. Blood tests and biochemical methods.

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board.

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 medical journals.

Breakdown of average student's workload

| | Hours | ECTS |
|---|-------|------|
| Total workload | 70 | 3,0 |
| Classes requiring direct contact with the teacher | 34 | 1,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) ¹ | 36 | 2,0 |

¹ delete or add other activities as appropriate