COURSE DESCRIPTION CARD - SYLLABUS

Course name

Physics

Course

Field of study

Aerospace Engineering

Year/Semester

2 / 3

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

1

Lecturers

Responsible for the course/lecturer:

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Faculty of Materials Engineering and Technical Physics

Piotrowo 3, 61-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Student has basic knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probability studies, analytical geometry necessary to understand and describe the basic issues related to modern physics.

Student has knowledge in the field of physics, including the basics of classical mechanics, optics, electricity and magnetism, thermodynamics, necessary to understand the issues of modern physics.

Student is able to obtain information from the indicated sources of literature, the Internet and other sources. Student can use formulas, tables and technical calculations.

Student understands the need to expand their competences and is ready to cooperate in a team.

Course objective

1. Familiarizing students with the basic concepts and laws of modern physics, to the extent specified by the curriculum content appropriate to the field of study, including their applications in technical sciences.

2. Developing students' skills in solving problems in contemporary physics, perceiving its potential applications in the studied field.

3. Developing students' skills in using literature and other sources.

Course-related learning outcomes

Knowledge

1. has expanded knowledge in mathematics, including algebra, analysis, theory of differential equations, probability studies necessary to understand and describe the basic issues related to solid state physics, atomic physics, nuclear physics, molecular physics and particle physics

2. has knowledge in the field of modern physics, including elements of relativity theory, solid state physics, atomic physics, nuclear physics, molecular physics and particle physics necessary to understand issues in the field of the theory of construction materials and materials science, theory of machines and mechanisms, theory of drives and mechatronic systems

3. has extended knowledge of solid state physics, atomic physics, nuclear physics, molecular physics and elementary particle physics, necessary to understand profile subjects in the field of aerospace engineering

Skills

1. has the ability to independently acquire knowledge and education in the field of solid state physics, atomic physics, nuclear physics, molecular physics and particle physics using modern teaching tools, such as websites and e-books

2. can obtain information from literature, the Internet and other sources in the field of solid state physics, atomic physics, nuclear physics, molecular physics and particle physics; interpret them and draw conclusions, formulate and substantiate opinions

3. can use formulas, among others to determine the wave function of particles, to calculate the occupation probability of energy levels in semiconductors, to evaluate a dose of electromagnetic radiation

Social competences

1. comply with the rules of professional ethics; is responsible for the reliability of the results of his work and their interpretation

2. understands the need for critical assessment of knowledge and continuous education in the field of relativity theory, solid state physics, atomic physics, nuclear physics, molecular physics and particle physics

3. understands the role he plays in society as a technical university graduate, in particular in formulating and providing the public with information and opinions related to technical achievements and other aspects of engineering activities related to solid state physics, atomic physics, nuclear physics, molecular physics and particle physics; makes efforts to provide such information and opinions in a way understandable to the majority of the society

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Assessment of knowledge and skills at the written or oral exam based on the explanation of selected issues in modern physics.

2. Current assessment of student activity in the lecture.

Programme content

1. Elements of relativity theory. Theory of special relativity. Postulates of special relativity. Time dilation and contraction of length. Lorenz transformation. Relativity of speed. Relativistic Doppler phenomenon. Momentum and energy valid for all physically allowed speeds. Rest energy. Total energy.

2. Photons and waves of matter. Quantum of light. Photoelectric effect. Schrödinger equation. Heisenberg uncertainty principle. Reflection and tunneling from the threshold of potential.

3. Electron energy in a trap. Electron wave functions. An electron in a finite potential well. Two- and three-dimensional electron traps. The hydrogen atom as an electron trap. Borh model of the hydrogen atom.

4. Properties of atoms. Stern-Gerlach experiment. Magnetic resonance. Pauli exclusion principle. Construction of the periodic table. X-rays. Lasers.

5. Electrical properties of solids. Energy levels in crystals. Isolators. Metals. Occupation probability. Semiconductors and doping. p-n junction. Transistor.

6. Nuclear physics. Radioactive decay. Dating methodologies. Radiation dose measurements. Nuclear models.

7. Nuclear energy. Nuclear fission. Nuclear reactor. Nuclear fusion.

8. Fundamental interaction. Standard model. Elementary particles. Fermions. Bosons. Cosmology.

Teaching methods

1. Lecture: presentation of program content in the form of a multimedia presentation, presentation of physical experiences in the form of multimedia films, simulation of physical phenomena using computer programs.

Bibliography

Basic

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 4 i 5, PWN 2014,

2. H. Haken, H. C. Wolf, Atomy i kwanty, PWN 2012,

3. J. Massalski, M. Massalska, Fizyka dla inżynierów, t. 1-2, WNT, Wydanie V.

Additional

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 1-3, PWN 2014,

2. I.W. Sawieliew, Wykłady z fizyki, t. 1-3, PWN 2013,

3. W. Moebs, S. J. Ling, J. Sanny, Fizyka dla szkół wyższych, t. 1-3, OpenStax, https://openstax.pl/pl

Breakdown of average student's workload

	Hours	ECTS
Total workload	34	1,0
Classes requiring direct contact with the teacher	17	0,5
Student's own work (literature studies, preparation for lectures, preparation for exam) [1]	17	0,5

[1] delete or add other activities as appropriate