COURSE DESCRIPTION CARD - SYLLABUS

Course name
Physics

Course

Field of study
CHEMICAL TECHNOLOGY

Year/Semester
I/1

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
45

Laboratory classes

Other (e.g. online)

Tutorials
15

Projects/seminars

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
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Faculty of Materials Science and Technical Physics

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Responsible for the course/lecturer:

Prerequisites

1. Knowledge in physics and mathematics (core curriculum for secondary schools, basic level).

2. Ability to solve elementary problems in physics based on the acquired knowledge.

3. Ability to use available information sources to obtain information from the indicated sources.

4. Understanding the necessity of education in order to obtain qualifications appropriate for the future profession and performing social functions.

Course objective

1. Provide students with basic knowledge in physics, within the scope defined by the program content appropriate for the field of study: Construction.

2. Developing students' skills in solving simple problems in the field of physics and analyzing the results based on the acquired knowledge.

3. The ability to interpret the observed phenomena in the surrounding world based on the known laws of physics and their practical use in the field of construction.

Course-related learning outcomes

Knowledge

W01 has knowledge of selected issues in: classical mechanics, gravity, oscillating and wave motion, acoustics, thermodynamics, electricity and magnetism, electromagnetic waves, optics and modern physics K_W02.

W02 knows the application of the basic laws of physics in the field of selected issues of: classical mechanics, gravity, oscillating and wave motion, acoustics, thermodynamics, electricity and magnetism, electromagnetic waves, optics and modern physics to describe phenomena in the surrounding world K_W02.

Skills

U01 is able to apply the basic laws of physics and simplified models to solve simple problems in the field of: classical mechanics, gravity, oscillating and wave motion, acoustics, thermodynamics, electricity and magnetism, electromagnetic waves, optics and modern physics K_U18 .

U02 is able to perceive and explain physical phenomena in the surrounding world on the basis of theoretical knowledge concerning selected issues of physics K_U17.

U03 can use the understanding of the indicated sources of knowledge (list of basic literature) and is active in acquiring knowledge from other sources K_U06.

Social competences

K01 is actively involved in solving the problems posed, independently developing and extending its competences K_K01.

K02 understands the need to expand knowledge of selected issues in physics in order to apply them in innovative solutions to technological and engineering problems in the field of construction K_K01.

K03 is responsible for the reliability of the results of its work, it follows the principles of ethics K_K02, K_K03.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written or oral examination - open questions, W01-W02, K01-W03

mark:

3 50.1% -70.0%

4 70.1% -90.0%

5 from 90.1%

test (open questions or questions for choosen of), U01-U02, K01-K03

3 50.1% -70.0%

4 70.1% -90.0%

5 from 90.1%

Programme content

1. Mechanics:

- kinematic and dynamic of translation (Newton's Laws, conservation of mechanical energy, conservation of linear momentum),
- kinematic and dynamic of rotation (Newton's second Law for rotation, conservation of angular momentum),
- oscillations: mechanical oscillations (simple harmonic motion (SHM), kinematics and energy of SHM, forced oscillations, damping, resonance),
- mechanical waves: transverse and longitudinal waves, the speed of a traveling wave, energy and power of a traveling wave, the principle of superposition for waves, interference of waves, standing waves, sound waves, ultrasounds, infrasounds, Doppler effect.

2. Gravitation:

- gravitational field and force, orbits and energy of satellites, effect of gravity on space-time, curvature of space.

3. Thermodynamics:

- The Zeroth, First and Second Law of Thermodynamics,
- the kinetic theory of gases,
- heat transfer mechanisms.

4. Electromagnetism:

- electric field (the electric field due to a point charge and an electric dipole, Coulomb's Law, the Gauss' Law: cylindrical, plannar and spherical symmetry, electric potential, capacitance),
- magnetic field (magnetic field due to a current, electrodynamic force, Biot–Savart Law,

Ampere's Law, Gauss' Law for magnetic, Faraday's Law of induction, Lenz's Law),

- charge particle in electric and magnetic field; cyclotrons and synchrotrons,
- conductivity/ the electrical properties of solids, energy levels in solids (metals, insulators, semiconductors, n-type and p-type semiconductors, the p-n junction), superconductors,
- magnetic materials (diamagnetism, paramagnetism, ferromagnetism).
- electromagnetic waves: Maxwell's equations, the electromagnetic spectrum.

5. Optics:

- reflection and refraction of light, total internal reflection of light, critical angle, white light, dispersion, diffraction, interference and polarization of light, diffraction gratings, Brewster's Law,
- travelling of electromagnetic waves in the medium (VIS and IR range) – classical and photonic optical fibres,
- lasers – work and applications.

6. Special theory of relativity (relativity, the speed of light postulate, mass and energy, time dilatation, length contraction, the twin paradox, Doppler effect of light).

7. Selected problems of modern physics:

- the hydrogen atom
- quantum nature of light (photons, the photoelectric effect),
- matter waves (de Broglie waves),
- Schrödinger's equation, Heisenberg's uncertainty principle,
- barrier tunneling effect – STM the scanning tunneling microscope,
- low-dimensional structures (nanocrystallites, quantum dots, quantum corrals, graphene).

Teaching methods

Presentation of the above-mentioned lecture issues in the form of a lecture presentation and experimental demonstrations.

Practice on the above-mentioned issues by solving problems for precisely defined conditions and data.

Bibliography

Basic

1.D.Halliday, R.Resnick, J.Walker, Fundamentals of Physics, John Wiley&Sons, Inc., New York 1997.

2. D.Halliday, R.Resnick, J.Walker, Podstawy fizyki tom: 1-5, PWN Warszawa 2003.

3. K.Jezierski, B.Kołodko, K.Sierański, Fizyka. Zadania z rozwiązaniami, t. 1-2, Oficyna Wydawnicza Scripta, Wrocław 2009.

Additional

VOLUME 1 https://openstax.org/details/books/university-physics-volume-1

VOLUME 2 https://openstax.org/details/books/university-physics-volume-2

VOLUME 2 https://openstax.org/details/books/university-physics-volume-3

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	75	
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	50	

[1] delete or add other activities as appropriate