



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Physics [S1IBiJ1>FIZ]

### Course

Field of study

Safety and Quality Engineering

Year/Semester

1/2

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

### Number of credit points

3,00

### Coordinators

dr inż. Szymon Maćkowiak

szymon.mackowiak@put.poznan.pl

### Lecturers

### Prerequisites

1. Student has basic knowledge in mathematics, including algebra, analysis, theory of differential equations, probability studies, analytical geometry necessary to understand and describe basic physics-related issues (core curriculum for secondary schools, extended level). 2. Student has basic knowledge in the field of physics (core curriculum for secondary schools, basic level). 3. Student is able to obtain information from the indicated sources of literature, the Internet and other sources. Can use formulas, tables and technical calculations. 4. Student understands the need to expand their competences and is ready to cooperate in a team.

### Course objective

1. To acquaint students with the basic classical physics concepts and laws, to the extent specified by the content of the curriculum relevant to the field of study, taking into account their applications in technical sciences. 2. Developing students' skills in solving problems in physics, perceiving its potential applications in the studied field. 3. Developing students' skills in solving problems in physics on the basis of acquired knowledge. 4. Acquainted with the elements of the technique of physical measurements and analysis of their results based on the knowledge obtained. 5. Developing students' teamwork skills. 6. Developing students' skills of independent learning, using literature and other sources.

## Course-related learning outcomes

### Knowledge:

1. Describes elements of vector calculus, including distinguishing between scalar and vector quantities and performing operations on vector quantities with geometric interpretation [K1\_W01].
2. Explains the principles of kinematics of a particle, identifying differences between rectilinear and curvilinear motion, and analyzes motion in the gravitational field [K1\_W01].
3. Characterizes the dynamics of a particle, including Newton's laws of motion, and explains phenomena such as friction, momentum, and work, power, and energy, in the context of conservative and non-conservative forces [K1\_W01].
4. Defines basic concepts related to the dynamics of a rigid body, including torque, moment of inertia, and applies the Steiner theorem to analyze rotational motion [K1\_W01].
5. Distinguishes conservation principles in mechanics, including the conservation of momentum, angular momentum, and energy, and discusses collisions of perfectly elastic and inelastic bodies [K1\_W01].
6. Explains the basics of the gravitational field, including the law of universal gravitation and Kepler's laws of planetary motion, and analyzes work in a gravitational field and field energy [K1\_W01].
7. Describes statics and dynamics of fluids, applying Archimedes' principle, Pascal's law, and Bernoulli's equation to analyze phenomena related to fluid viscosity [K1\_W01].
8. Identifies the elastic properties of bodies and applies Hooke's law to describe material behaviors under external forces [K1\_W01].
9. Characterizes the basics of thermodynamics and heat transfer mechanisms, explaining differences between conduction, convection, and radiation [K1\_W01].
10. Analyzes simple, damped, and forced harmonic motion, including the phenomenon of resonance, with application to practical engineering problems [K1\_W01].

### Skills:

1. Uses vector calculus to solve physical problems related to the kinematics and dynamics of a particle and a rigid body [K1\_U01].
2. Plans and conducts physical experiments, applying conservation principles in mechanics to analyze physical phenomena, and interprets results using appropriate analytical methods [K1\_U11].
3. Applies physical laws to analyze and solve complex engineering problems, including those related to the gravitational field, statics and dynamics of fluids, and elastic properties of bodies [K1\_U01].

### Social competences:

1. Develops responsibility for the results of one's own scientific and experimental work, demonstrating an understanding of the importance of accuracy and reliability in engineering activities [K1\_K07].
2. Works effectively in a team, coordinating activities related to the design and implementation of physical experiments, appreciating the value of collaboration and sharing knowledge in a scientific and engineering context [K1\_K07].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Assessment of knowledge and skills as part of the LECTURE is verified during a 90-minute written exam based on the explanation of selected physics issues presented during the lecture. In a situation where the grade of the written exam cannot be clearly determined, an oral exam is carried out. Additionally, lecture activity is evaluated. Passing rate: 50% of points.
2. Assessment of knowledge and skills in the EXERCISE is verified on the basis of a 90-minute colloquium carried out during the last class based on the calculation of tasks from the issues presented in class. Additionally, activity during exercises is assessed. Pass rate: 50% of points.
3. Assessment of knowledge and skills within the LABORATORY is verified on the basis of an oral conversation with the student or a written 10-15 minute colloquium at the beginning of the class, before proceeding with the measurements. Score for reports based on results. In addition, student work evaluation during measurements. Completion of the course based on a positive assessment (minimum grade 3.0) of theoretical preparation for classes and reports on all exercises carried out during the course.

## Programme content

1. elements of vector calculus (scalar and vector quantities, operations on vector quantities; geometric interpretation).

2. material point kinematics (uniform and variable rectilinear and curvilinear motion, motion in the field of gravity).
3. material point dynamics (Newton's dynamics, friction, momentum, work, power and energy, conservative and non-conservative forces).
4. rigid body dynamics (moment of force, moment of inertia, Steiner's theorem, principles of rotational dynamics, angular momentum, kinetic energy of rotational motion).
5. principle of conservation in mechanics (principle of conservation of angular momentum, angular momentum, energy), collisions of bodies (perfectly elastic and inelastic), static of a rigid body (simple machines).
6. gravitational field (universal gravitation law, Kepler's laws of planetary motion, weight, field strength, field work, field energy, field potential).
7. statics and dynamics of fluids (Archimedes' law, Pascal's law, Bernoulli's equation, liquid viscosity).
8. elastic properties of bodies (Hooke's law).
9. elements of thermodynamics (heat transfer mechanisms).
10. simple, damped, forced harmonic motion - resonance.
11. mechanical waves (wave refraction and reflection, diffraction and interference phenomena, Doppler effect, basics of acoustics).
12. electric field (Coulomb's law, electric field strength and potential, work of electric field forces, Gauss's law).
13. electric current (direct current, Ohm's law, electrical conductivity).
14. magnetic field (Lorentz force, electrodynamic force).
15. electromagnetic induction (induction flux, Faraday's law, Lenz's rule).
16. electromagnetic waves (Maxwell equations).
17. geometrical and physical optics.
18. elements of special relativity (Galilean transformation, Lorentz transformation, time dilation, length contraction).

### Course topics

none

### 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.
2. Exercises: presenting how to solve tasks on the board, calculating the tasks given by the teacher during the classes on the board and outside classes.
3. Laboratory: presentation of results analysis methods on the board and measurements using laboratory equipment, discussing directly with the student how to make reports, including identifying errors in the analysis.

### Bibliography

Basic:

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 1-4, PWN 2014,
2. J. Massalski, M. Massalska, Fizyka dla inżynierów, t. 1-2, WNT, Wydanie V,
3. J. Kalisz, M. Massalska, J. Massalski, Zbiór zadań z fizyki z rozwiązaniami, PWN, Warszawa 1971
4. S. Szuba, Ćwiczenia laboratoryjne z fizyki, Wydawnictwo Politechniki Poznańskiej, Poznań 2007,

Additional:

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 5, PWN 2014,
2. W. Moebs, S. J. Ling, J. Sanny, Fizyka dla szkół wyższych, t. 1-3, OpenStax, <https://openstax.pl/pl>
3. I.W. Sawieliew, Wykłady z fizyki, t. 1-3, PWN 2013,
4. K. Jezierski, B. Kołodka, K. Sierański, Fizyka. Zadania z rozwiązaniami. Cz. 1, Oficyna Wyd. Scripta, Wrocław 2000,
5. Jezierski, B. Kołodka, K. Sierański, Fizyka. Zadania z rozwiązaniami. Cz. 2, Oficyna Wyd. Scripta, Wrocław 1999,
6. K. Jezierski, B. Kołodka, K. Sierański, Fizyka. Repetytorium, zadania z rozwiązaniami, Oficyna Wyd. Scripta, Wrocław 2003,
7. K. Łapsa, Ćwiczenia laboratoryjne z fizyki, Wydawnictwo Politechniki Poznańskiej, Poznań 2008,

8. H. Szydłowski, Pracownia fizyczna, PWN, Warszawa 2003.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00