Politechnika Krakowska im. Tadeusza Kościuszki

Karta przedmiotu

obowiązuje studentów rozpoczynających studia w roku akademickim 2022/2023

Wydział Inżynierii Lądowej

Kierunek studiów: Budownictwo

Profil: Ogólnoakademicki

Forma sudiów: stacjonarne

Kod kierunku: BUD

Stopień studiów: I

Specjalności: Bez specjalności - studia w języku angielskim

1 Informacje o przedmiocie

Nazwa przedmiotu	Fizyka
Nazwa przedmiotu w języku angielskim	Physics
Kod przedmiotu	WIL BUD oIS B8 22/23
Kategoria przedmiotu	Przedmioty podstawowe
Liczba punktów ECTS	4.00
Semestry	1

2 Rodzaj zajęć, liczba godzin w planie studiów

Semestr	Wykład	Ćwiczenia audytoryjne	Laboratoria	Laboratoria komputerowe	Projekty	Seminarium
1	30	15	15	0	0	0

3 Cele przedmiotu

Cel 1 Course Goal 1. Delivering a concise and systematic overview of fundamentals of physics and applications of modern physics in current technology and engineering.

Cel 2 Course Goal 2. Providing students with an in-depth knowledge on selected topics in physics which are relevant for modern construction and understanding properties of building materials.

Cel 3 Course Goal 3. Providing students with an opportunity to learn elements of metrology, practical aspects of measurements and uncertainties in physics and engineering.

Cel 4 Course Goal 4. Facilitating personal development through the acquisition and use of a wide range of transferable and practical skills.

4 Wymagania wstępne w zakresie wiedzy, umiejętności i innych kompetencji

1 Prerequisite 1. Basic English communication skills.

2 Prerequisite 2. Having an open mind for new ideas and being prepared for enjoyable and worthwhile studies in the field of physics.

3 Prerequisite 3. Prior courses in physics at a secondary school level are not essential, albeit they may be helpful.

5 Efekty kształcenia

EK1 Wiedza Learning Outcome 1. (Knowledge). Knowledge of most of the fundamental laws and principles of physics and competence in the application of these principles to diverse areas of engineering, including civil engineering and modern construction.

EK2 Wiedza Learning Outcome 2. (Knowledge). Knowledge of scientific theoretical and experimental methods used in physics, understanding uncertainties in measurements with applications in civil engineering.

EK3 Umiejętności Learning Outcome 3. (Skills). Ability to solve problems in physics using appropriate mathematical and computational tools: ability to identify the relevant physical principles, translate problems into mathematical statements and obtain valid numerical solutions expressed in suitable physical units.

EK4 Umiejętności Learning Outcome 4. (Skills). Ability to execute an experiment or scientific (or engineering) investigation: demonstrating critical analysis of the results and drawing valid conclusions.

EK5 Umiejętności Learning Outcome 5. (Skills). Ability to communicate scientific or engineering information to a range of audiences, discussing scientific problems within the scope of acquired knowledge and producing accurate and concise technical and academic reports based on the lab work or solved problems in physics.

EK6 Kompetencje społeczne Learning Outcome 6. (Social Competences). Ability to manage one's work, motivation and time schedule, adopt a responsible attitute towards problems and challenges in a scientific or commercial environment, achieve goals in a logical, organised and ethical manner.

6 Treści programowe

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W1	Motivation for the physics course. Physics background for engineering. Physics and measurement. Measurements and uncertainties, Dimensional analysis. Conversion of units. Estimates and order-of-magnitude calculations. Significant figures.	2
W2	Mechanics of particles (point-like masses). Motion in one and two dimensions. Position, velocity and acceleration. Instantaneous velocity and acceleration - calculus-based definitions. Motion diagrams. Kinematic equations derived from calculus. Examples: freely falling objects, projectile motion, circular (uniform) motion.	2

Wykład		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
W3	The Laws of motion. The concept of force. Inertial frames of reference. Galilean Transformation. Linear momentum conservation law from Newton's laws of motion. Newton's Second Law and its application to physical model analysis - examples. Conditions for an equillibrium state. Newton's Law of Universal Gravitation. Gravitational force: mass and weight. Forces of friction. Motion in the presence of resistive forces. Motion in noninertial (accelerated) frames.	6
W4	Systems and their interaction with environments. Energy of a system. Work done by a constant and varying force. Kinetic energy and the work-kinetic theorem. Potential energy of a system. Conservative and non-conservative forces. Relationship between conservative forces and potential energy. Gravitational potential energy. The Earth density. Gravimetry. Isolated and non-isolated systems. The total mechanical energy conservation law. Power. Collisions. Systems of many particles - the center of mass. Motion of the center of mass. Rocket propulsion.	6
W5	Rigid objects and their motion. Angular position, velocity and acceleration. Angular versus translational quantities. Torque. Equations of motion. Model of a rigid object under a net torque. Moments of inertia. The parallel axis (Huygens-Steiner) theorem. Moment of inertia calculations using calculus and dimensional aanalysis and self-similarity concept.	4
W6	Motion in a central force field. Total angular momentum conservation law. Kepler's Laws and the motion of planets. Planet and satellite motion - energy considerations.	2
W7	Static equilibrium and elasticity. Rigid objects in equilibrium. Deformations. Elastic properties of solids. Young's modulus. Sheer modulus. Bulk modulus. Fluid mechanics. Pressure. Pascal's principle. The force exerted on a dam. Buoyant forces and Archimedes's Principle. Fluids and ideal fluids. Fluid dynamics. Bernoulli's equation. Some applications of fluid dynamics. Venturi tube. Torricelli's law. Viscosity. Non-Newtonian fluids.	2
W8	Oscillatory motion. Mass on a spring. A number of masses connected with springs. Damped oscillations. Forced oscillations. The resonance. Wave motion. Travelling waves. Waves on a string. The linear wave equation. The speed of waves. Reflection and transmission. Sound waves. The Doppler effect. Standing waves. Beats. Interference. Light waves.	2
W9	Thermodynamics. Equilibrium, near-equilibrium and non-equilibrium processes. Heat and temperature. Laws of thermodynamics. Entropy. Heat transfer.	2
W10	Modern physics. Special theory of relativity. Lorentz-Fitzgerald transformation. General theory of relativity. Atomic clocks. Global positioning systems and geodesy. Elements of quantum physics. Quantum properties of materials. Applications of quantum physics - modern microscopy.	2

Ćwiczenia audytoryjne		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
C1	Methodology of solving problems in physics. Estimating orders of magnitude. Dimensional analysis. Kinematics of point-like mass particles. Motion under constant acceleration. Relationship among position, velocity and acceleration. Making graphs. Uniform circular motion.	3
C2	Finding equilibrium conditions for stationary systems of point-like masses connected with ropes and pulleys. Finding tensions in connecting ropes. Analysis of dynamics of simple mechanical systems. Solving equations of motion with resistive forces.	3
C3	Conservation of linear momentum. Conservation of total mechanical energy. Elastic and inelastic collisions. Ballistic pendulum. Satellite and planetary motion.	3
C4	Calculations of moment of inertia for solids of various shapes. Dynamics of solids rotating around fixed axis. Swinging rod. Galileo's Paradox. Rotational and translational motion. Energy in rotational motion. Equilibrium conditions for a leaning ladder against the wall.	3
C5	Assessment tests. Mid-term test 1, 2 and 3. Tools for remote teaching, including e-learning platform PK will be used.	3

Laboratoria		
Lp	Tematyka zajęć Opis szczegółowy bloków tematycznych	Liczba godzin
L1	Determination of acceleration due to gravity using a simple pendulum. Quality of measurements and quality control. Methods of measurements, data analysis, evaluation of experimental results and uncertainties. Significant figures. Standards in presenting experimental data. Assessment methods will include use of e-learning platform PK.	3
L2	Measurement of stress in a loaded cantilever beam.	3
L3	Light and waves. One of the exercises from the list given below: 1. Properties of light polarization. 2. Determination of sound speed in the air. 3. Measurement of wavelength using a diffraction grating.	3
L4	Properties of solids and liquids. One of the exercises from the list given below: 1. Heat transport. 2. Determination of densities of solids and liquids. 3. Determination of fluid viscosity 4. Measurement of Young's modulus.	3
L5	Modern physics. One of the exercises from the list given below: 1. Studies of magnetic field with a hallotron. 2. Determination of the electrochemical equivallent of hydrogen 3. Identification of atomic spectra using a spectrometer.	3

7 Narzędzia dydaktyczne

N1 Lectures, presentations and demonstrations

N2 Tutorials and in-class or remote discussions

N3 Laboratory exercises with use of e-learning platform

N4 Homework and self-study

N5 Consultations

8 Obciążenie pracą studenta

Forma aktywności	Średnia liczba godzin na zrealizowanie aktywności
Godziny kontaktowe z nauczycielem akademickim, w tym:	
Godziny wynikające z planu studiów	60
Konsultacje przedmiotowe	15
Egzaminy i zaliczenia w sesji	5
Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:	
Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury	10
Opracowanie wyników	10
Przygotowanie raportu, projektu, prezentacji, dyskusji	10
e-learning platform activities	10
Sumaryczna liczba godzin dla przedmiotu wynikająca z całego nakładu pracy studenta	**120**
Sumaryczna liczba punktów ECTS dla przedmiotu	4.00

9 Sposoby oceny

The total course outcome (the score) is measured by the outcome index obtained as a weighted average out of various partial grades (e.g. attendance, mid-term tests, physics lab grade, the exam). The index is expressed in per cents. The final grade is assigned according to the linear grading scheme. Assessment methods and the exam will include activities available through dedicated e-learning platforms at the University.

Ocena formująca

F1 Attendance

F2 Preparation for classes

F3 Performance/activity/answers during classes

F4 Lab reports and the final Physics Lab grade

F5 Mid-term tests

F6 The final exam

Ocena podsumowująca

P1 The final course grade follows from the grading scheme for obtained score which is weighted average out of the partial grades.

Warunki zaliczenia przedmiotu

W1 Condition 1. Passing grade from lab exercises

W2 Condition 2. Passing grade from tutorials (classes)

W3 Condition 3. Passing grade from the final exam

W4 Condition 4. Performance meet the minimum criteria for the learning outcomes

Ocena aktywności bez udziału nauczyciela

B1 Students' activity via MS Teams or e-learning platform PK dedicated to our Physics course: eg. quizzes, assignments, spreadsheets, posted questions.

Kryteria oceny

Efekt kształcenia 1	
Na ocenę 2.0	The outcome index is below 51 %.
Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Knowledge of most of the fundamental laws and principles in physics meets the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.
Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent knowledge of most of the fundamental laws and principles of physics is demonstrated.
Efekt kształcenia 2	
Na ocenę 2.0	The outcome index is below 51 %.
Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Knowledge of experimental methods used in physics meets the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.

Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent knowledge of scientific theoretical and experimental methods used in physics is demonstrated.
Efekt kształcenia 3	
Na ocenę 2.0	The outcome index is below 51 %.
Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Ability to solve problems in physics using appropriate mathematical tools meet the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.
Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent skills to solve physical problems are demonstrated.
Efekt kształcenia 4	
Na ocenę 2.0	The outcome index is below 51 %.
Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Ability to perform an engineering experimental investigation meets the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.
Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent skills to execute an experiment are demonstrated.
Efekt kształcenia 5	
Na ocenę 2.0	The outcome index is below 51 %.
Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Ability to communicate engineering information meets the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.
Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent skills and abilities to communicate scientific or engineering information are demonstrated.
Efekt kształcenia 6	
Na ocenę 2.0	The outcome index is below 51 %.

Na ocenę 3.0	The outcome index is in the range of 51 % - 60 % approximately. Social competences related to one's work organization, achieving goals in a logical manner meet the minimum criteria.
Na ocenę 3.5	The outcome index is in the range of 61 % - 70 % approximately.
Na ocenę 4.0	The outcome index is in the range of 71 % - 80 % approximately.
Na ocenę 4.5	The outcome index is in the range of 81 % - 90 % approximately.
Na ocenę 5.0	The outcome index is equal to 91 % or more. Excellent abilities to manage one's work and achieve goals in a logical, organised way are demonstrated.

10 Macierz realizacji przedmiotu

Efekt kształcenia	Odniesienie danego efektu do szczegółowych efektów zdefiniowanych dla programu	Cele przedmiotu	Treści programowe	Narzędzia dydaktyczne	Sposoby oceny
EK1	K_W01	Cel 1 Cel 2 Cel 4	w1 w2 w3 w4 w5 w6 w7 w8 w9 w10 c1 l1	N1 N2 N4 N5	F1 F2 F3 F5 F6 P1
EK2	K_W01 K_W13	Cel 1 Cel 2 Cel 3 Cel 4	w1 w2 w3 w4 w5 w6 w7 w8 w9 w10 l1	N1 N2 N3 N4 N5	F1 F2 F3 F4 F5 F6 P1
EK3	K_U05 K_U06 K_U17 K_U18 K_K09	Cel 1 Cel 2 Cel 3 Cel 4	c1 c2 c3 c4 c5 l1 l2 l3 l4 l5	N1 N2 N3 N4 N5	F1 F2 F3 F4 F5 F6 P1
EK4	K_U05 K_U13 K_U14 K_U17 K_K09	Cel 1 Cel 2 Cel 3 Cel 4	c5 l1 l2 l3 l4 l5	N1 N2 N3 N4 N5	F1 F2 F3 F4 F5 F6 P1
EK5	K_U18 K_K08	Cel 2	l1 l2 l3 l4 l5	N1 N2 N3 N4 N5	F1 F2 F3 F4 F5 F6 P1
EK6	K_K09 K_K10	Cel 1 Cel 2 Cel 3 Cel 4	w1 w2 w3 w4 w5 w6 w7 w8 w9 w10 c1 c2 c3 c4 c5 l1 l2 l3 l4 l5	N1 N2 N3 N4 N5	F1 F2 F3 F4 F5 F6 P1

11 Wykaz literatury

Literatura podstawowa

[1] R. A. Serway and J. W. Jewett — *Physics for Scientists and Engineers*, Cheriton House, UK, 2018, Brooks Cole/Cengage

[2] B. Oleś, S. Stachniewicz and R. Gębarowski — *Physics Laboratory for Civil Engineering*, Kraków, 2019, E-learning Platform, Politechnika Krakowska

Literatura uzupełniająca

[1] D. Halliday, R. Resnick, J. Walker — *Fundamentals of Physics*, New York, 2013, John Wiley & Sons

[2] K. Riley — *Mathematical methods for the physical sciences: an informal treatment for students of physics and engineering*, , 1974, Cambridge University Press

Literatura dodatkowa

[1] David Morin — *Introductory Classical Mechanics with Problems and Solutions*, Cambridge (US), Harvard University, 2003, David Morin, Harvard University

[2] Deepto Chakrabarty, Peter Dourmashkin, Michelle Tomasik, Anna Frebel, and Vladan Vuletic — *8.01SC Classical Mechanics. Fall 2016*, Cambridge (US), MIT Open Courseware, 2016, Massachusetts Institute of Technology

12 Informacje o nauczycielach akademickich

Osoba odpowiedzialna za kartę

dr Robert Gębarowski (kontakt: rgebarowski@pk.edu.pl)

Osoby prowadzące przedmiot

1 dr Robert Gębarowski (kontakt: rgebarowski@pk.edu.pl)

2 dr Barbara Oleś (kontakt: pk.tutor@gmail.com)

13 Zatwierdzenie karty przedmiotu do realizacji

(miejscowość, data) (odpowiedzialny za przedmiot) (dziekan)

Przyjmuję do realizacji (data i podpisy osób prowadzących przedmiot)

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