Fundamentals of physics I - Mechanics - course description

General information

Course name	Fundamentals of physics I - Mechanics
Course ID	13.2-WF-FizP-FP-I-M-S17
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	First-cycle studies leading to Bachelor's degree
Beginning semester	winter term 2019/2020

Course information

Semester	1
ECTS credits to win	8
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. Andrzej Drzewiński

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	45	3	-	-	Exam
Class	45	3	-	-	Credit with grade

Aim of the course

The first objective of this course is to acquaint students with the development of concepts and methods of physics. Executed in parallel, and most important goal is to get the student's ability for understanding and rigorous description of physical phenomena in the field of mechanics. Thanks to demonstrations accompanying lectures, verbal communication is illustrated by numerous examples.

Prerequisites

Knowledge of mathematics and physics at the high school level

Scope

LECTURE:

- *History and methodology of science*: basic physical quantities and their measurement, the international SI system of units, coordinate systems, vectors and vector quantities in physics

- *Kinematics*: kinematics of uniform motion, linear motion, motion in two and three dimensions, velocity and acceleration

- *The dynamics of linear motio*n: the dynamics of material point, force and motion, mass and weight, the principles of Newtonian dynamics, friction

- *Frames of reference*: inertial and non-inertial, Galileo and Lorentz transformations

- *Circular motion dynamics*: *uniform* circular *motion*, the forces of inertia, the Coriolis force

- *Energy*: kinetic and potential energy, work and power, principle of the conservation of energy

- *Collisions*: momentum and the principle of conservation of momentum, elastic inelastic collisions

- *Gravitational interaction*: Kepler's laws, Newton's law of universal gravitation, the work force in a gravitational field, the first and second cosmic velocity

- *Rotary rigid body motion*: rigid body, center of mass, the principle of Steiner's, progressive and rotary motion, the principle of conservation of angular momentum

- *Statics*: a state of equilibrium, inclined plane, equilibrium of rigid bodies

- *Oscillatory motion and waves*: deformation of the bodies, harmonic vibrations, the elastic wave motion and the principle of superposition, interference and diffraction, standing waves, Doppler effect

- *Statics and dynamics of fluids*: Archimedes' principle, Pascal's law, the principle of continuity, Bernoulli's law

CLASS:

- *Vectors.* Adding vectors. Multiplication of vectors.

- *Motion in one dimension.* Average and instantaneous velocity. Accelerated motion. Freely falling bodies.

- *Motion in two and three dimensions.* Position, velocity, acceleration. Projectile motion. Relative motion. *Newton's laws.* Force, mass. Applications of Newton's laws. Frictional forces.

- *Work and energy.* Work done by a constant force and by a variable force. Kinetic energy and the work. Power.

- *Conservation of energy.* Conservative forces. Potential energy. One-dimensional conservative systems.

- *System of particles.* Two- and many-particle systems. Center of mass. Linear momentum of a particle and system of particles. Conservation of linear momentum.

- *Collisions.* Conservation of momentum during collisions. One- and two-dimensional collisions. *Rotational kinematics.* Rotational motion. The rotational variables. Rotation with constant angular acceleration. Relationship between linear and angular variables.

Teaching methods

Classes are in the form of lectures illustrated with demonstrations. During the lecture the student is encouraged to ask questions, while during the demonstration the students are also encouraged to actively participate. On the exercises, students analyze and solve problems with a teacher.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student understands the relationship between energy and work and can give various examples of potential energy . Student knows the conservation laws in mechanics and can use them to solve problems of mechanics. Student knows the law of universal gravitation and can apply to motion of the planets.	• K1A_W01 • K1A_W02 • K1A_W03 • K1A_U01	• an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
Student knows the principle of superposition of forces and the principle of superposition of motions. Student knows and is able to apply Newton's principles, in the inertial and non-inertial reference frame. Student can describe wave motion and the superposition principle. Student understands the general method in physics: breaking problems down into idealized models, as the perfectly elastic collision.	• K1A_W01 • K1A_W02 • K1A_W03 • K1A_U01	• an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
Based on the concept of work and energy can explain Bernoulli's Pronciple and apply them to simple problems of fluid dynamics.	• K1A_U01	• an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class
Student understands the role of inertial mass and its distribution in the analysis of rigid body motion and is able to calculate the moment of inertia for the basic bodies, like a ring, rod or ball.	• K1A_W01 • K1A_W02 • K1A_W03 • K1A_U01	• an exam - oral, descriptive, test and other • an observation and evaluation of activities during the classes	• Lecture • Class

Assignment conditions

The exam is conducted in writing. Student receives four issues to consider requiring the knowledge of the issues and ability to combine different phenomena. For each task, one can get from 0 to 5 points. Received a positive rating requires at least 8 points (a sufficient for 8-10.5 points, a plus sufficient for 11-13.5 points, a good 14-16, a plus good 16.5-18.5 points, a very good 19-20 points).

The basis of assessment exercises is attendance and passing written tests.

The exercises must be completed before the exam begins.

The final grade is the weighted grade from two parts: exercises (40%) and final exam (60%).

Recommended reading

[1] D. Halliday, R. Resnick, J. Walker, Podstawy fizyki, tom 1 i 2, Wydawnictwo Naukowe PWN, Warszawa 2005.
[2] B. Jaworski, A. Dietłaf, L. Miłkowska, G. Siergiejew, Kurs fizyki, tom 1, PWN, Warszawa 1976.
[3] I. W. Sawieliew, Kurs fizyki, tom 1, Wydawnictwo Naukowe PWN, Warszawa 2002.
[4] L. D. Landau, J. M. Liftszyc, Mechanika, Wydawnictwo Naukowe PWN, Warszawa 2007.

Further reading

[1] A. K. Wróblewski, Historia fizyki, Wydawnictwo Naukowe PWN, Warszawa 2007.

Notes

Modified by dr hab. Piotr Lubiński, prof. UZ (last modification: 14-01-2020 11:06)