Interactions and Bodies

Educational subject description sheet

Basic information

Field of study Joint Bachelor in Sustainability	**Education cycle** 2025/26
Speciality Sustainable Physics & Chemistry	**Subject code** UJ.WPAJBSSPCS.880.16408.25
Organizational unit Faculty of Law and Administration	**Lecture languages** english
Study level first cycle (joint degree programme)	**Subject related to scientific research** Yes
Study form full-time degree programme	**Disciplines** Physical sciences
Education profile General academic	**ISCED classification** 0533 Physics
Mandatory obligatory	**USOS code**

Subject coordinator	Piotr Szwedo
Lecturer	Waldemar Kulig

Period Semester 4	**Examination** exam **Activities and hours** Lecture: 28 Classes: 14	**Number of ECTS points** 5.0

Goals

C1	The aim of the course is to get to know the laws of physics using a physical formalism that is also usable in later stages of studies. In the course, the student practices modelling real-world systems with physical models.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	how to model a physical system by recognizing interactions.	JBS_K1_W06, JBS_K1_W07	written exam, credit
W2	how to analyze the behaviour of a system also with the energy principle.	JBS_K1_W06, JBS_K1_W07	written exam, credit
Skills – Student can:			
U1	model a physical system by recognizing interactions, writing the equations of motion, and solving it.	JBS_K1_U03	written exam, credit
U2	implement vector algebra, including the dot product, both in Cartesian and spherical coordinates.	JBS_K1_U03	written exam, credit
U3	take derivative and integrate vector functions in component form.	JBS_K1_U03	written exam, credit
U4	solve simple differential equations from the equations of state with the trial approach.	JBS_K1_U03	written exam, credit

Calculation of ECTS points

Activity form	Activity hours*
Lecture	28
Classes	14
preparation for classes	28
exercises performance	40
preparation for the exam	25

Student workload	Hours	ECTS
	135	5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	Interactive lecture: Distance, speed and acceleration, trajectory curves, momentum. Mathematics in physics: vectors and differentiation.	W1
2.	Interactive lecture: Kinematics, from momentum to force, momentum principle. Mathematics in physics: integration and numerical solution.	W1
3.	Interactive lecture: Fundamental interactions, gravitational and electric forces, conservation of momentum, center of mass.	W1

No.	Course content	Subject's learning outcomes
4.	Interactive lecture: Contact forces, friction, spring force. Repetition of the harmonic oscillator. Mathematics in physics: solving a differential equation by trial function.	W1
5.	Interactive lecture: Contact forces, friction, spring force. Repetition of the harmonic oscillator.	W1
6.	Interactive lecture: Circular motion.	W1
7.	Interactive lecture: Energy. Mechanical work. Energy principle	W1, W2
8.	Interactive lecture: Energy principle. Kinetic, potential, and rest energy, conservative and non-conservative systems. Mathematics in Physics: binomial approximation.	W1, W2
9.	Interactive lecture: Bond energy, change of mechanical energy and dissipative interactions, internal and thermal energy.	W1, W2
10.	Exercise session: Exercises on the previous week’s lecture material	W1, W2, U1, U2, U3, U4

Course advanced

Teaching methods :

conversation lecture, solving tasks, practicals

Activities	Examination methods	Credit conditions
Lecture	written exam	More than 45% of points are required to pass the exam. The final exam constitutes 100% of the final grade.
Classes	credit	Active participation (non-graded). Additionally, points gathered from the weekly exercise sets can give a student up to 15% bonus points to the final exam score. Bonus points is based on the amount of correctly completed exercises. It is not compulsory to hand-in the weekly exercise sets.

Entry requirements

None

Literature

Obligatory

1. Chabay, R. and Sherwood, B.: Matter & Interactions, Willey, 4th edition, 2014, chapters 1-8.

Effects

Code	Content
JBS_K1_U03	The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.
JBS_K1_W06	The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities).
JBS_K1_W07	The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.