



## Subject card

Subject name and code	Physics, PG_00038427						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			7.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Metrology and Information Systems -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Maciej Łuszczek					
	Teachers	dr inż. Maria Chomka dr hab. inż. Maciej Łuszczek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	30.0	0.0	0.0	0.0	75
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study	SUM	
	Number of study hours	75	10.0		90.0	175	
Subject objectives	Introduction to the basic laws of physics. Understanding of the role of physics in our environment and introduction of the methods of mathematically precise description of natural phenomena. Implementation of the differential and integral calculus in physical problems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_K02] can work in a group taking on different roles in it						
	[K6_W02] has basic knowledge of physics and chemistry including electrostatics, electromagnetism, electrodynamics, wave motion, acoustics, mechanics, thermodynamics, optics, solid state physics; including knowledge necessary to understand the basic physical phenomena occurring in hydrogen devices, systems and installations as well as automation and robotics systems						
[K6_U01] Is able to obtain information from literature, databases and other sources, integrate them, interpret them and draw conclusions and formulate opinions; has the ability to self-educate m.in. in order to improve professional competences	Student is able to use various bibliographic resources and can make correct conclusions.			[SU1] Assessment of task fulfilment			

Subject contents	<p><b>1. Mechanics</b></p> <p><b>Kinematics:</b> basic concepts and quantities, rectilinear motion with constant acceleration, relativity of motion, projectile motion, circular motion.</p> <p><b>Dynamics:</b> Newton's principles, inertial and non inertial reference systems, transnational motion dynamics, rotational motion dynamics</p> <p><b>Conservation laws in dynamics:</b> conservation of energy, momentum and angular momentum</p> <p><b>2. Gravity:</b> Newton's law of universal gravitation, gravitational potential energy, escape velocity</p> <p><b>3. Vibrations and waves.</b></p> <p><b>Simple harmonic motion:</b> equation of motion. energy, mathematical pendulum, physical pendulum, superposition of harmonic motions</p> <p><b>Damped harmonic motion.</b></p> <p><b>Forced vibrations and resonance.</b></p> <p><b>Waves in elastic media:</b> classification of waves, wave propagation, superposition of waves, standing waves.</p> <p><b>Sound waves:</b> audible sounds, ultra- and infrasound, standing acoustic waves, beats, Doppler's effect</p> <p><b>4. Thermodynamics:</b> states of matter, heat, calorimetric calculations, ideal gas law, thermodynamic processes, kinetic theory of gases, internal energy, work in thermodynamic processes, reversible and non reversible processes, thermodynamic cycles, Carnot's engine.</p> <p><b>5. Wave optics essentials:</b> Huygens principle, reflection and refraction of light, interference and diffraction of light.</p>														
Prerequisites and co-requisites															
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 1328 794 1361">Subject passing criteria</th> <th data-bbox="799 1328 1137 1361">Passing threshold</th> <th data-bbox="1142 1328 1481 1361">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1361 794 1395">Exam</td> <td data-bbox="799 1361 1137 1395">50.0%</td> <td data-bbox="1142 1361 1481 1395">50.0%</td> </tr> <tr> <td data-bbox="456 1395 794 1429">Written test</td> <td data-bbox="799 1395 1137 1429">50.0%</td> <td data-bbox="1142 1395 1481 1429">25.0%</td> </tr> <tr> <td data-bbox="456 1429 794 1462">Written test</td> <td data-bbox="799 1429 1137 1462">50.0%</td> <td data-bbox="1142 1429 1481 1462">25.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Exam	50.0%	50.0%	Written test	50.0%	25.0%	Written test	50.0%	25.0%
Subject passing criteria	Passing threshold	Percentage of the final grade													
Exam	50.0%	50.0%													
Written test	50.0%	25.0%													
Written test	50.0%	25.0%													
Recommended reading	<table border="1"> <tbody> <tr> <td data-bbox="456 1473 794 1630">Basic literature</td> <td colspan="2" data-bbox="799 1473 1481 1630">           C. Bobrowski, "Fizyka - krótki kurs"             D. Halliday, R. Resnick, J. Walker, "Podstawy fizyki"         </td> </tr> <tr> <td data-bbox="456 1630 794 1664">Supplementary literature</td> <td colspan="2" data-bbox="799 1630 1481 1664">R. Feynman, "Feynman Lectures on Physics"</td> </tr> <tr> <td data-bbox="456 1664 794 1697">eResources addresses</td> <td colspan="2" data-bbox="799 1664 1481 1697">Adresy na platformie eNauczanie:</td> </tr> </tbody> </table>			Basic literature	C. Bobrowski, "Fizyka - krótki kurs"  D. Halliday, R. Resnick, J. Walker, "Podstawy fizyki"		Supplementary literature	R. Feynman, "Feynman Lectures on Physics"		eResources addresses	Adresy na platformie eNauczanie:				
Basic literature	C. Bobrowski, "Fizyka - krótki kurs"  D. Halliday, R. Resnick, J. Walker, "Podstawy fizyki"														
Supplementary literature	R. Feynman, "Feynman Lectures on Physics"														
eResources addresses	Adresy na platformie eNauczanie:														

<p>Example issues/ example questions/ tasks being completed</p>	<p>Explain basic concepts and quantities in kinematics - position, velocity, acceleration.</p> <p>Discuss three Newton's principles of dynamics.</p> <p>Explain the notion of gravitational potential energy.</p> <p>Discuss energy transfer (kinetic to potential and vice versa) during the motion of mathematical pendulum.</p> <p>What does the term "standing wave" stand for?</p> <p>Discuss two arbitrarily chosen thermodynamic processes.</p>
<p>Work placement</p>	<p>Not applicable</p>