

**Subject card**

<b>Subject name and code</b>	Physical laboratory - electromagnetism and thermodynamics, PG_00190909						
<b>Field of study</b>	Nuclear safety and radiological protection						
<b>Date of commencement of studies</b>	October 2026		<b>Academic year of realisation of subject</b>		2027/2028		
<b>Education level</b>	Bachelor's studies		<b>Subject group</b>		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
<b>Mode of study</b>	full-time studies		<b>Mode of delivery</b>		at the university		
<b>Year of study</b>	2		<b>Language of instruction</b>		Polish		
<b>Semester of study</b>	3		<b>ECTS credits</b>		3.0		
<b>Learning profile</b>	academic		<b>Assessment form</b>		credit		
<b>Conducting unit</b>							
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr Joanna Gondek				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	0.0	0.0	45.0	0.0	0.0	45
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	45		0.0		45.0	90
<b>Subject objectives</b>	deepening knowledge and understanding of the basic principles of physical phenomena through independent conduct and theoretical analysis of the results of selected physical experiments in electromagnetism and thermodynamics.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BJORL3_K07] Is prepared to make independent decisions as well as to work within a team, where assumes responsibility for the consequences of these actions.	<p>The student is aware of:</p> <ul style="list-style-type: none"> <li>– the need to cooperate with members of the research group in order to correctly conduct a physical experiment;</li> <li>– the need to constructively evaluate their own work and that of other members of the research group;</li> </ul> <p>The student is aware of:</p> <ul style="list-style-type: none"> <li>– the need to cooperate with members of the research group in order to correctly conduct a physical experiment;</li> <li>– the need to constructively evaluate their own work and that of other members of the research group;</li> <li>– the need to perform the tasks assigned to them reliably and on time;</li> <li>– the need to comply with the rules on intellectual property protection and the legal and ethical conditions related to research activities.</li> </ul>	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report
	[BJORL3_K08] He is ready to think and act entrepreneurially.	<p>Student:</p> <ul style="list-style-type: none"> <li>– is able to precisely formulate problems and doubts related to the task at hand and present their own proposals for solving them.</li> </ul>	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report
	[BJORL3_U09] Can independently plan and implement his own learning.	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– search for reliable sources of knowledge and information;</li> <li>– complete assigned tasks on time.</li> </ul>	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report
	[BJORL3_U02] Has the ability to perform measurements of basic quantities used in physics and chemistry; can develop, describe and present the results of simple experiments and computer simulations; can perform quantitative analyses and formulate qualitative conclusions on this basis; can estimate measurement uncertainties.	<p>The student is able to:</p> <ul style="list-style-type: none"> <li>– present and use knowledge of electromagnetism and thermodynamics in experimental work,</li> <li>– perform a quantitative analysis of the studied physical phenomena in electromagnetism and thermodynamics,</li> <li>– apply mathematical apparatus to describe and analyze physical phenomena in electromagnetism and thermodynamics,</li> <li>– plan and conduct physical experiments in electromagnetism and thermodynamics,</li> <li>– use computer software to analyze and present measurement data,</li> <li>– determine the uncertainty of the measurement data obtained,</li> <li>– draw qualitative conclusions about the phenomenon under study from the experimental results obtained.</li> </ul>	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report

	Course outcome	Subject outcome	Method of verification
	<p>[BJORL3_W03] Knows how to plan and perform a simple physical or chemical experiment and analyze the results obtained; knows the elements of the theory of measurement uncertainty as applied to experiments; knows the basic units of the SI system and its most important derived units; knows other systems of measurement units.</p>	<p>The student knows and understands:</p> <ul style="list-style-type: none"> <li>– basic models, quantities, and physical laws of electromagnetism and thermodynamics,</li> <li>– principles of planning and conducting physical experiments with an emphasis on research in electromagnetism and thermodynamics,</li> <li>– principles of collecting and analyzing measurement data,</li> <li>– methods of calculating measurement data uncertainty,</li> <li>– units of physical quantities in electromagnetism and thermodynamics from various systems of measurement;</li> <li>– the construction and operating principles of basic measuring instruments used in experiments in electromagnetism and thermodynamics.</li> </ul>	<p>[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report</p>
	<p>[BJORL3_W02] Understands the role of physical and chemical experimentation, mathematical theoretical models approximating reality, and computer simulations in scientific research methodology; is aware of technological, apparatus, and methodological limitations in scientific research.</p>	<p>The student knows and understands:</p> <ul style="list-style-type: none"> <li>– basic concepts, physical quantities, and regularities of electromagnetic and thermodynamic phenomena,</li> <li>– the role of physical experiments in understanding the regularities of mechanical phenomena,</li> <li>– experimental limitations in the study of electromagnetic and thermodynamic phenomena,</li> <li>– the concept of measurement accuracy;</li> <li>– the construction and operating principles of basic measuring instruments used in experiments in electromagnetism and thermodynamics.</li> </ul>	<p>[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report</p>

Subject contents	<p>Methods of measuring electromagnetism using electronic techniques. Planning measurements, constructing measurement systems, performing measurements, assessing measurement uncertainty. Experimental investigation of the basic principles of electrical, magnetic, electromagnetic and thermodynamic phenomena:</p> <p>relaxation oscillations</p> <p>determination of the electrochemical equivalent of copper and Faraday's constant</p> <p>AC rectification. Greatz circuit</p> <p>RLC resonance circuit (series circuit)</p> <p>thermocouple calibration</p> <p>calculation of capacitor capacity using a discharge curve</p> <p>resistance determination using a Wheatstone bridge</p> <p>characteristics of a tungsten filament light bulb and a resistance wire heater</p> <p>study of the phase shift between the current and voltage of alternating current</p> <p>determining the magnetic field inside a solenoid using a Hall effect sensor</p> <p>study of the transformer</p> <p>determining the Cp/Cv ratio using the Clement-Desormes method</p> <p>determining the elasticity coefficient of gases using a gas thermometer</p> <p>determining the thermal expansion coefficient of solids</p> <p>determining the relationship between boiling point and pressure, and the heat of vaporization of water</p> <p>determining the heat of fusion of ice using a calorimeter</p> <p>determining the change in entropy of a system</p> <p>determining the thermal conductivity coefficient of air</p> <p>determining the specific heat of water</p> <p>determining the adiabatic exponent for air</p> <p>determining the work done on gas in adiabatic and isothermal thermodynamic processes</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	reports	51.0%	60.0%
	oral responses	51.0%	40.0%
Recommended reading	Basic literature	not applicable	

	Supplementary literature	not applicable
	eResources addresses	
Example issues/ example questions/ tasks being completed	not applicable	
Work placement	Not applicable	

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