



## Subject card

Subject name and code	Experimentarium (Individual) / Introduction to Research Work, PG_00070192						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	February 2026	Academic year of realisation of subject			2025/2026		
Education level	second-cycle studies	Subject group			Optional subject group Specialty subject group Subject group related to scientific research 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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Functional Materials Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Sebastian Molin					
	Teachers	dr hab. inż. Sebastian Molin					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	5.0	0.0	55.0	0.0	0.0	60
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 4385 Eksperymentarium (indywidualne) / Wstęp do prac badawczych <a href="https://enauczanie.pg.edu.pl/2025/course/view.php?id=4385">https://enauczanie.pg.edu.pl/2025/course/view.php?id=4385</a>						
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	60	3.0	12.0	75		
Subject objectives	The aim of the course is to familiarize students with the fundamentals of laboratory work in the field of hydrogen technologies and electromobility. During the classes, students learn basic laboratory procedures, safety principles, and laboratory work organization. The course covers research planning, performing basic physical and electrical measurements, and analyzing the obtained results. The acquired skills prepare students for independent research work in the context of their future master's thesis.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	<p>[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: - developing the achievements of the profession, - observing and developing rules of professional ethics and acting to comply to these rules</p>	<p>The student is ready to responsibly perform laboratory work in compliance with safety rules, reliably document research results, and adhere to professional ethics and good research practices in teamwork.</p>	<p>[SK1] Assessment of group work skills</p>
	<p>[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of hydrogen technologies and electromobility, gained in the professional engineering environment</p>	<p>The student is able to critically analyze measurement methods used in the laboratory and evaluate the correctness and adequacy of selected research techniques in relation to the investigated physical and electrical properties of materials and systems related to hydrogen technologies and electromobility.</p>	<p>[SU2] Assessment of ability to analyse information</p>
	<p>[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of hydrogen technologies and electromobility, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of hydrogen technologies and electromobility, including computer simulations, interpret the obtained results and draw conclusions</p>	<p>The student is able to plan and conduct basic laboratory experiments involving physical and electrical measurements, select appropriate measuring instruments, record results, and perform their analysis and interpretation using IT tools.</p>	<p>[SU4] Assessment of ability to use methods and tools</p>
	<p>[K7_U10] can individually plan and pursue their own lifelong education and influence others in this aspect, also by means of advanced information and communication technologies (ICT), and communicate on specialist issues with diverse recipients, appropriately justify points of view, hold debates, present, assess and discuss different opinions and points of view, as well as use specialist terminology related to the field of hydrogen technologies and electromobility in communication</p>	<p>The student is able to independently plan the course of laboratory research, develop a work schedule, and present and discuss the obtained results in the form of a report, using specialized terminology in the field of hydrogen technologies and electromobility.</p>	<p>[SU5] Assessment of ability to present the results of task</p>

Subject contents	<p>Course content – lecture</p> <p>W1 (1h) - Introduction to laboratory work. Health and safety rules in the research laboratory. Organization of the measurement workstation.</p> <p>W2 (1h) - Fundamentals of metrology. Types of physical and electrical measurements. Measurement uncertainty and errors.</p> <p>W3 (1h) - Methods of research experiment planning. Formulating hypotheses and research objectives. Selection of experimental parameters.</p> <p>W4 (1h) - Measurement techniques used in research of materials and systems for hydrogen technologies and electromobility. Overview of measurement equipment.</p> <p>W5 (1h) - Principles of processing and presenting research results. Laboratory documentation. Ethics in research work and good scientific practices.</p> <p>Course content – laboratory</p> <p>L1 (5h) - Health and safety training and laboratory familiarization. Rules for safe work with measurement apparatus. Laboratory regulations and available research equipment overview.</p> <p>L2 (5h) - Introduction to the research process. Scientific literature review methods of searching, evaluating, and analyzing sources. Using scientific databases.</p> <p>L3 (5h) - Defining the research problem. Formulating research questions and hypotheses. Determining the objectives and scope of the planned research.</p> <p>L4 (5h) - Experiment planning. Selection of measurement methods and experimental parameters. Developing a work schedule and research procedure.</p> <p>L5 (5h) - Preliminary work Part I. Sample and measurement workstation preparation. Instrument calibration. Performing trial measurements.</p> <p>L6 (5h) - Preliminary work Part II. Verification of trial measurement repeatability. Optimization of measurement conditions. Research procedure correction.</p> <p>L7 (5h) - Research iteration Measurement series I. Conducting the first complete measurement series according to the developed procedure. Data recording and preliminary control.</p> <p>L8 (5h) - Analysis of series I results. Statistical data processing. Identification of trends, anomalies, and potential error sources. Assessment of result quality.</p> <p>L9 (5h) - Research iteration Measurement series II. Conducting the second measurement series incorporating conclusions from series I analysis. Comparison of both series results.</p> <p>L10 (5h) - Critical analysis of data and results. Comparison of obtained results with literature data. Discussion of uncertainty sources and method limitations.</p> <p>L11 (5h) - Research report preparation structure, presentation of results in tables and charts, formulating conclusions. Preparation for results presentation.</p>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 972 794 992">Subject passing criteria</th> <th data-bbox="799 972 1137 992">Passing threshold</th> <th data-bbox="1142 972 1481 992">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 999 794 1025">assessment of final presentation</td> <td data-bbox="799 999 1137 1025">60.0%</td> <td data-bbox="1142 999 1481 1025">70.0%</td> </tr> <tr> <td data-bbox="456 1032 794 1077">assessment of interim progress presentation</td> <td data-bbox="799 1032 1137 1077">60.0%</td> <td data-bbox="1142 1032 1481 1077">30.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	assessment of final presentation	60.0%	70.0%	assessment of interim progress presentation	60.0%	30.0%
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Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<ul style="list-style-type: none"> <li>• W.D. Callister, D.G. Rethwisch <i>Materials Science and Engineering: An Introduction</i>, Wiley</li> <li>1. E. Barsoukov, J.R. Macdonald <i>Impedance Spectroscopy: Theory, Experiment, and Applications</i>, Wiley</li> </ul>										
Example issues/ example questions/ tasks being completed												
Practical activities within the subject	Not applicable											

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