



## Subject card

Subject name and code	Methods of Experiment Design, PG_00057505						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
Education level	second-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			English		
Semester of study	1	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Dąbrowski				
	Teachers		dr inż. Paweł Dąbrowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	30
	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	30		7.0		13.0	50
Subject objectives	The subject aims to familiarize students with the idea of experimental work, from planning the experiment, through the acquisition and interpretation of measurement data, to drawing conclusions based on them. In addition, the subject aims to familiarize students with the importance of measurement uncertainty in experimental research as well as to show good practices in conducting experimental work. This subject will teach the student how to plan and run an experiment, and how to interpret the data and compare it with scientific theories, taking into account measurement uncertainty.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W81] has knowledge of complex grammatical structures and diverse lexical resources needed to communicate in foreign language in terms of general and specialist language related to field of study	The ability to use extensive grammatical structures and various lexical fields passively during participation in lectures and in an active manner during a presentation on experiment design in the field of energy sciences	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
	[K7_W05] knows basic methods, techniques and tools used in solving complex engineering tasks in the field of modeling of thermal-energy systems	The ability to design an experiment in the field of thermal-flow processes and theoretically elaborate the results, using a variety of techniques and tools, including the calculation of measurement uncertainty	[SW2] Assessment of knowledge contained in presentation
	[K7_U81] is able to communicate with ease in foreign language at B2+ level of the Common European Framework of Reference for Languages (CEFR) in everyday life, in academic and professional environments	The ability to communicate fluently in English during lectures and seminars, both in everyday life and in the academic and professional environment	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information
	[K7_K82] is equipped to participate actively in lectures, seminars and laboratory classes conducted in foreign language	The ability to participate in lectures conducted in English and to deliver a presentation in English	[SK4] Assessment of communication skills, including language correctness
	[K7_K81] is able to cooperate in international team at her/his own university, during work placement and during study abroad	The ability to work in a small team in the field of experiment design and preparing and delivering a presentation in English	[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness
[K7_U82] is able to proficiently obtain and process information related to field of study and academic environment in foreign language at B2+ level of the Common European Framework of Reference for Languages (CEFR)	The ability to use professional literature in English concerning experiment design, experimental research, and data analysis in the field of energy sciences	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information	
Subject contents	<ol style="list-style-type: none"> <li>1. Basic concepts</li> <li>2. Experiment in historical and philosophical perspective</li> <li>3. Examples of simple experiments</li> <li>4. Basics of experiment design</li> <li>5. Input, output, control, dependent, and independent variables</li> <li>6. Qualitative and quantitative measurements</li> <li>7. Uncertainties and measurement errors</li> <li>8. Acquisition of measurement data</li> <li>9. Statistical analysis of measurement data</li> <li>10. Utilization of measurement data for calculations</li> <li>11. Numerical methods as an experiment aiding tools</li> <li>12. Good practices in designing and conducting experimental research</li> <li>13. Designing and conducting an experiment - a case study</li> <li>14. Presentation of the group work results</li> </ol>		
Prerequisites and co-requisites	The knowledge of basic mathematical concepts with particular emphasis on the concepts of mathematical statistics. Basic knowledge in the field of thermal-flow measurements. Knowledge of English at a level that allows an oral presentation.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture - written test	60.0%	60.0%
	Seminar - presentation	60.0%	40.0%
Recommended reading	Basic literature	1. Montgomery D.C. Design and analysis of experiments. Eighth Edition. Wiley & Sons, 2013, ISBN: 978-1-118-14692-7	
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Abu-Mulaweh H. Integration a ddesign of experiment in the heat transfer laboratory. Annual Conference Proceedings, 2003, DOI: 10.18260/1-2--11948</li> <li>2. Luiten W. Design of experiments in thermal architecture. 23rd International Workshop on Thermal Investigations of ICs and Systems (THERMINIC), 2017, DOI: 10.1109/THERMINIC.2017.8233785</li> <li>3. Prima EC, Utari S, Chandra DT, Hasanah L, Rusdiana D. Heat and temperature experiment designs to support students conception on nature of science. Journal of Technology and Science Education, 2018, DOI: 10.3926/jotse.419</li> </ol>	

	eResources addresses	Adresy na platformie eNauczenie: Methods of Experiment Design, W, E, sem.01, letni 22/23 (PG_00057505) - Moodle ID: 29153 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29153">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29153</a> Methods of Experiment Design, W, E, sem.01, letni 22/23 (PG_00057505) - Moodle ID: 29153 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29153">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29153</a>
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Definitions: experiment, input variable, output variable, control variable, dependent variable, independent variable, repeatability, sensitivity</li> <li>2. Measurement uncertainty</li> <li>3. Statistical analysis of measurement data</li> <li>4. Differences between experimental and non-experimental research</li> <li>5. False positive results</li> <li>6. Double-blind design</li> <li>7. Design an experiment to measure the emissivity of the body</li> <li>8. Influence of various factors on the results of the experiment</li> </ol>	
Work placement	Not applicable	