GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Methods of experiment design, PG_00065884		
Field of study	Nuclear Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Dąbrowski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	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	5.0	15.0	50

Subject objectives

The subject aims to familiarize students with experimental work, from planning the experiment to drawing conclusions based on them. In addition, the subject aims to familiarize students with the importance of measurement uncertainty in experimental research and to show good practices in their conducting. 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, considering measurement uncertainty.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K82] is equipped to participate actively in lectures, seminars and laboratory classes conducted in foreign language	Student hypothesizes in English about conducting experiments related to energy issues	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice
[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 student performs measurement uncertainty calculations based on the content of the tasks in English	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[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 student explains the terms related to the methods of experiment design in English	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W04] recognizes and interprets selected issues in the field of advanced detailed knowledge, particularly in the scope of methods, techniques, tools, algorithms and standards specific to Nuclear Power Technologies taking into account the principles of safety and radiological protection	The student plans an experiment involving thermal and flow issues, using experimental designs	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation

<table>
<tr><td>Subject contents</td><td>Course content – lecture

1. Basic concepts
2. Experiment in historical
3. Examples of simple experiments
4. Basics of experiment design
5. Input, output, control, dependent, and independent variables
6. Uncertainties and measurement errors
7. Statistical analysis of measurement data
8. Utilization of measurement data for calculations
9. Numerical methods as an experiment aiding tools
10. Good practices in designing and conducting experimental research
11. Designing and conducting an experiment - a case study</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>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 active participation in lectures and tutorials.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Tutorial - written test</td><td>60.0%</td><td>40.0%</td></tr><tr><td>Lecture - written test</td><td>60.0%</td><td>60.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. Montgomery D.C. Design and analysis of experiments. Eighth Edition. Wiley & Sons, 2013, ISBN: 978-1-118-14692-7</td></tr><tr><td>Supplementary literature</td><td>1. Abu-Mulaweh H. Integration a ddesign of experiment in the heat transfer laboratory. Annual Conference Proceedings, 2003, DOI: 10.18260/1-2--11948
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
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</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Definitions: experiment, input variable, output variable, control variable, dependent variable, independent variable, repeatability, sensitivity
2. Indicate the differences (and provide an example) between: experiment and observation, hypothesis and theory, mechanistic and empirical model, types of experimental methods, measurement error and uncertainty, accuracy and precision of measurement, descriptive and inferential statistics
3. Measurement uncertainty calculations
4. Statistical analysis of experimental data
5. False positive results
6. Design an experiment to measure: the emissivity of the body, the heat conductivity of solid material, the heat conductivity of fluid
7. Influence of various factors on the results of the experiment</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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