GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Experiment planning and error analysis, PG_00064826						
Field of study	Mechanical 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 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	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_W04] demonstrates knowledge covering selected topics of advanced specific knowledge, in particular methods, techniques, tools specific to Mechanics and Mechanical Engineering processes, systems and equipment	The student verifies the possibility of conducting an experiment using a given scientific method	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	The student summarizes the latest inventions and technologies in the field of mechanical engineering	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_U14] integrates information obtained from literature and other properly selected sources, including those in a foreign language, creatively interpreting and critically evaluating them, and drawing conclusions	The student summarizes the valuable experimental studies described in the literature	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K7_U03] plans and carries out experimental investigations to determine the parameters of devices, processes or systems in the field of Mechanical Engineering and Mechanical Engineering, appropriately selects methods, techniques and tools, interprets results and estimates measurement errors	The student plans experimental research to determine the impact of various variables on the operation of devices and systems	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment

Subject contents

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

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.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture - written test	60.0%	60.0%
Tutorial - written test	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	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
eResources addresses	

Example issues/ example questions/ tasks being completed

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

Practical activites within the subject

Not applicable

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