GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Experiment design and analysis, PG_00061894		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	first-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	Polish
Semester of study	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Barbara Kościelska	
	Teachers	prof. dr hab. inż. Barbara Kościelska dr inż. Piotr Okoczuk dr hab. inż. Marcin Łapiński dr inż. Ewa Głowińska	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	30.0	0.0	0.0	60

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 982 Metody planowania i analizy eksperymentu
https://enauczanie.pg.edu.pl/2025/course/view.php?id=982

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	5.0	60.0	125

Subject objectives

The aim of the course is to familiarize the student with basic information regarding the process of planning, performing and publishing experimental data.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U11] Is able to notice non-technical aspects when forming and solving project tasks, including environmental, economic and legal aspects. Applies the rules of occupational health and safety.	The student knows and understands the hazards in laboratory work. Student basic principles of research ethics.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	The student is able to analyze a series of measurement data, present the results in the form of clear graphs, and analyze measurement uncertainties	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U01] Can properly use selected analytical, simulation and experimental methods, as well as devices for measuring the fundamental properties of materials and technological processes.	The student is able to plan an experiment and conduct simple measurement experiments. Is able to correctly analyze the received measurement data	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student is able to plan an experiment and conduct simple measurement experiments. Is able to correctly analyze the received measurement data	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment

Subject contents	**Lectures/exercises** 1. Sources of scientific and non-scientific knowledge. 2. Measurement errors and uncertainties. 3. Statistical distribution of measurements. 4. Measurements and measurement uncertainties of complex quantities. 5. Graphical and tabular presentation of measurement results. 6. Determination of physical parameters from graphs. 7. Linear regression method. Planning simple physical experiments. 8. Principles of presenting measurement results. Creating a report. 9. Principles of preparing scientific publications. **Laboratory** 1. Planning of experiments in the field of chemistry in accordance with the principles of green chemistry and BAT (best available technologies). 2. The Reach system as a determinant in planning chemical experiments and selecting raw materials for syntheses. 3. Methods of planning experiments and measurements of engineering materials, including methods of detecting errors in measurement techniques. 4. Quantitative analysis using spectrophotometry based on calibration curve, dependence of absorbance on concentration of standard substance, Lambert-Beer law. 5. Procedure for preparation of standard solutions, analysis of changes in conditions (e.g. temperature, batches of reagents), preparation of the work curve for each day of measurement. 6. Calculation of expected value based on arithmetic mean of results, standard deviation, and elimination of gross errors.
Prerequisites and co-requisites	Knowledge of mathematics at secondary school level
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture and exercises: written exam common to both parts	50.0%	50.0%
Laboratory - passing all laboratory exercises	50.0%	50.0%

Recommended reading	Basic literature	**Lecture/exercises** 1. B. Kusz, Metody wykonywania pomiarów oraz szacowanie niepewności pomiaru (https://pg.edu.pl/files/ftims/2021-03/wstep.pdf) 2. K. Kozłowski, R. Zieliński I Laboratorium z Fizyki część I Wydawnictwo PG. 3. Dudkiewicz J, Kusz B, Laboratorium z Fizyki, część 2, Wydawnictwo PG. 4. Wstęp do analizy błędu pomiarowego, Wydawnictwo PWN **Laboratory** 1. B. Burczyk, Zielona chemia. Zarys, Oficyna Wydawnicza Politechniki Wrocławskiej, 2014 2. Najlepsze Dostępne Techniki (BAT) Wytyczne dla Branży Chemicznej w Polsce (https://www.ekoportal.gov.pl/fileadmin/Ekoportal/Pozwolenia_zintegrowane/poradniki_branzowe/ 11.5 Systemy Obrobki Zarzadzania Wodami i Gazami Odpadowym 3. https://www.gov.pl/web/rozwoj-technologia/system-reach 4. Analiza statystyczna w laboratorium badawczym, PWN, Wojciech Hyk, Zbigniew Stojek
	Supplementary literature	-
	eResources addresses	

Example issues/ example questions/ tasks being completed	**Lecture/exercises** 1. Calculate the standard deviation for the given series of experimental data. 2. Provide the sources of measurement uncertainties. 3. Draw a line graph from the given data, calculate the slope of the line and the fit coefficient. **Laboratory** 1. Determination of a calibration curve taking into account all points for individual concentrations, with rejection of gross errors for various measuring devices: glass pipettes and measuring cylinders. 2. Preparation of detailed tables of results for individual students and the mean and standard deviation. 3. Calculation of SSE for parameters a and b, along with a description of the uncertainty for the result of a sample with an unknown concentration. 4. Application of the dilution method in the preparation of the standard curve, as well as the tested sample. 5. Determination of LOD and LOQ for the obtained curve. 6. Designing and making a simple research device and conducting an experiment. For example, measuring air temperature. 7. Taking a series of measurements and correlating the number of cars in a parking lot with the air temperature.
Work placement	Not applicable

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