



## Subject card

Subject name and code	Planning and analysis of experiment, PG_00060211						
Field of study	Technical Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	first-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			Polish		
Semester of study	1	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Electron Collisions Physics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Paweł Możejko					
	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		40.0		75
Subject objectives	The aim of the course is to present the measurements procedures of physical quantities and the analysis of statistical and systematic uncertainties.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U04] is able, individually or in a team, to plan and conduct experiments in physics and related fields, including applied computer science or energy engineering, and to analyse and interpret results and formulate conclusions.	The student is able to calculate measurement uncertainties. The student is able to calculate mean values and their standard deviations. The student is able to perform basic direct measurements and design an experiment to determine a selected physical quantity.			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K6_W04] has advanced knowledge of the principles of experimental design, experimental methods, measurement techniques and scientific equipment used in physics and related sciences, including their life cycle.	The student understands the principles of uncertainty analysis, is familiar with statistical distributions and their applicability in the analysis of measurement uncertainties and the verification of hypotheses. The student is familiar with methods for measuring and selected derived physical quantities.			[SW1] Assessment of factual knowledge		

## Subject contents

### Course content – lecture

- 1.) Experimental results and their uncertainties
- 2.) Propagation of uncertainties
- 3.) Statistical analysis of random uncertainties
- 4.) The normal distribution
- 5.) The standard deviation, standard deviation of the mean and the normal distribution
- 6.) Weighted averages
- 7.) Least-squares fitting
- 8.) The covariance and correlation
- 9.) The binomial distribution, the Poisson distribution
- 10.)  $\chi^2$  test
- 11.) t-Student distribution
- 12.) Graphical presentation of the results of measurements
- 13.) Basic measuring instruments (caliper, micrometer, etc..)
- 14.) Measurements of the basic physical quantities
- 15.) Planning of the experiment

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### Course content – exercises

- 1.) Experimental results and their uncertainties
- 2.) Propagation of uncertainties
- 3.) Statistical analysis of random uncertainties
- 4.) The normal distribution
- 5.) The standard deviation, standard deviation of the mean and the normal distribution
- 6.) Weighted averages
- 7.) Least-squares fitting
- 8.) The covariance and correlation
- 10.) Graphical presentation of the results of measurements
- 11.) Basic measuring instruments (caliper, micrometer, etc..)

	12.) Measurements of the basic physical quantities		
	13.) Planning of the experiment		
Prerequisites and co-requisites	Knowledge and of the basic algebraic operations Knowledge of the basic elementary functions of one variable Ability to think analytically		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	50.0%
		60.0%	50.0%
Recommended reading	Basic literature	J.R. Taylor "Wstęp do analizy błędu pomiarowego", PWN, Warszawa 2012  Andrzej Zięba "Analiza danych w naukach ścisłych i technice", PWN, Warszawa 2014  S. Brandt "Analiza danych", PWN, Warszawa 2002  H. Szydłowski "Teoria Pomiarów", PWN, Warszawa 1981  H. Szydłowski "Pracownia Fizyczna", PWN, Warszawa 1999	
	Supplementary literature	K. Kozłowski, R. Zieliński "I Laboratorium z Fizyki", Wydawnictwo PG, Gdańsk 2003	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1) Calculation of the arithmetic mean, standard deviation and standard deviation of the mean  2) Graphical presentation of the measured data  3) Calculation of measurement error using the combined standard uncertainty method  4) Calculation of weighted average  5) The analysis of statistical data with the normal distribution  6) Linear function fit to the measured data  7) Calculation of the linear regression coefficient and its analysis  8) Implementation of simple measurements using a calliper and a micrometer		
Practical activities within the subject	Not applicable		

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