



## Subject card

Subject name and code	Metrology and Measurement Systems, PG_00060454						
Field of study	Mechanical and Naval Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
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	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Manufacturing and Production Engineering -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Aleksandra Laska				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	18.0	9.0	9.0	0.0	0.0	36
	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	36		6.0		58.0	100
Subject objectives	Recognition with the basic principles of metrology and preparing to conduct measurements of mechanical sizes with the analysis of the results. Rules for determining the accuracy, tolerance and fits of machine parts. Knowledge of the methods of measurement and measuring instruments.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W11] has knowledge of analysis, design, technology and manufacturing of selected technical systems, machinery and equipment, metrology and quality control, knows and understands methods of measurement and calculation of basic quantities describing the operation of technical systems, knows basic calculation methods used to analyse experimental results	The student knows the theoretical basis of measurement methods and techniques. The student defines the basic parameters of measured quantities used in mechanics. The student knows the basics of coordinate measurement technique and methods for measuring the geometric structure of surfaces.	[SW1] Assessment of factual knowledge
	[K6_U15] is able to select appropriate measuring tools and techniques for qualitative verification of manufactured or in-service machinery and ship parts, is able to make basic measurements using basic measuring tools for qualitative verification of machinery and ship parts	The student explains the construction and principles of operation of measuring instruments. The student selects an appropriate measuring instrument to measure a specific physical quantity. The student makes measurements using various methods and measuring instruments. The student analyzes the measurement results. The student calculates the values of measurement uncertainty.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
	[K6_W07] knows the principles of engineering drawing, standards and tools used in preparation of technical documentation	The student knows the basic methods of determining the amount of tolerance and the position of the tolerance range in relation to the nominal dimension in technical documentation. The student determines geometric deviations and parameter values of the geometric surface structure in the technical specification.	[SW1] Assessment of factual knowledge
Subject contents	Basic concepts in metrology: measurement, units of measurement, standards and instruments. Accuracy and uncertainty. The geometrical structure of the product (Geometrical Product Specifications - GPS). Basics of tolerances, deviations and fits. Geometric tolerances. General Tolerances - Tolerances for linear and angular dimensions without individual tolerance indications. Fundamentals of measurements (repeatability and reproducibility of a measuring device). Surface texture. Metrological methods and equipment and principles of its selection. Laboratory: Measurements of external, internal, mixed and intermediate dimensions. Measurement of angles, cones,. Measurements of surface texture and contours. Measurements with the use of altimeters. 2D measurements. Coordinate measuring technique (manual and CNC measuring machines). Tutorials: Measurements and their uncertainty (Measurement errors, uncertainty, uncertainty budget and statistical analysis of measurement results). Tolerances and fits. Dimensional chains. Tolerance of component dimensions, interchangeability. Thread tolerance.		
Prerequisites and co-requisites	Basic knowledge of technical drawing		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tutorial	60.0%	30.0%
	Lecture	60.0%	40.0%
	Laboratory	60.0%	30.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. W. Jakubiec, J. Malinowski: Metrologia wielkości geometrycznych. WNT, Warszawa 2018.</li> <li>2. S. Białas, Z. Humienny, K. Kiszka: Metrologia z podstawami specyfikacji geometrii wyrobów (GPS). Oficyna wydawnicza PW, Warszawa 2014.</li> <li>3. S. Adamczak, W. Makiela: Metrologia w budowie maszyn. WNT, Warszawa 2021.</li> <li>4. T. Sałaciński: Ćwiczenia laboratoryjne z metrologii. Oficyna wydawnicza PW, Warszawa 2015.</li> <li>5. T. Sałaciński: Elementy metrologii wielkości geometrycznych. Przykłady i zadania. Oficyna wydawnicza PW, Warszawa 2013.</li> </ol>	
	Supplementary literature	<ol style="list-style-type: none"> <li>1. E. Ratajczyk: Współrzędnościowa technika pomiarowa. OWPW, Warszawa 2005</li> <li>2. J. Jezierski: Analiza tolerancji i niedokładności pomiarów w budowie maszyn. WNT Warszawa 2003</li> <li>3. A. Boryczko: Podstawy pomiarów wielkości mechanicznych. Wydawnictwo PG, Gdańsk 20104.</li> <li>4. A. Meller, P. Grudowski: Laboratorium metrologii warsztatowej i inżynierii jakości. <a href="http://www.wbss.pg.gda.pl">http://www.wbss.pg.gda.pl</a> ,podręczniki (format PDF)</li> </ol>	
	eResources addresses	Adresy na platformie eNauczanie:	

Example issues/ example questions/ tasks being completed	1. Dimensional analysis of the mechanism.  2. Types of hole and shaft fits.  3. Methods and measuring instruments.
Work placement	Not applicable