POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of metrology [S1ZiIP1>PM]

Course

Field of study	Year/Semester
Management and Production Engineering	2/3
Area of study (specialization)	Profile of study
–	general academic
Level of study	Course offered in
first-cycle	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	0

Tutorials	Projects/seminars	
0	0	

Number of credit points
4,00

Coordinators

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Lecturers

Prerequisites

Knowledge of mathematical analysis and statistics, technical drafting and machine element design. The desire to gain new knowledge and skills. The ability of logical thinking and making use of information acquired from various sources.

Course objective

Learning the basics of metrology, the characteristics of patterns and measuring instruments. The acquisition of knowledge on the ways and principles of the measurement of selected geometrical quantities and of the skills to use measurement equipment. The acquisition of knowledge on measurement methods, the error estimate and the calculation of uncertainty of measurement, both direct and indirect. Raising the awareness of the role of metrology in 4.0 Industry and of its influence on manufactured products.

Course-related learning outcomes

Knowledge:
1. The student knows the International System of Units (SI) - [K_W01, K_W03]
2. The student knows the definitions and the classification of particular types of errors plus their elimination or estimation - [K_W03, K_W10]

3. The student knows the statistical methods to process measurement results - [K_W10, K_W25]
4. The student knows the rules of measurement uncertainty estimation - [K_W10, K_W25]
5. The student knows and is able to define deviations of shape, location, position and runout - [K_W10]
6. The student knows the basic measurement equipment, used for the measurements of machine parts - [K_W10, K_W11]

Skills:
1. The student knows how to check a measurement instrument acc. to instructions - [K_U13]
2. The student knows how to calculate the value of uncertainty for direct and indirect measurements - [K_U01]
3. The student is able to determine the uncertainty of measurement of an instrument by A and B method - [K_U04]
4. The student is able to determine parameters of the static characteristic curve of a measurement transducer - [K_U01]
5. The student is able to carry out a statistical analysis of measurement results - [K_U01, K_U13]
6. The student is able to analyse the tolerances of product manufacture and knows the principles of part fit - [K_U01, K_U13]

Social competences:
1. The student has the awareness of performing proper measurements of machine parts - [K_K01]
2. He/she is able to defend performed metrological calculations - [K_K02]
3. He/she is able to develop on his/her own knowledge in the field of metrology - [K_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: Written examination credit
Laboratory: Credits from oral or written answers to questions in the scope of each performed laboratory exercise plus drawing up of report. In order to obtain a credit, all the exercises shall be completed.

Programme content

1. Measurement theory, the measurement and its essence, measurement results, measurement methods, types and techniques
2. The International System of Units (SI), the definition of the metre
3. Etalons , measurement standards of length and angle, gauge blocks, measuring cylinders and tolling balls, angular plates, angles, and the hierarchy of patterns
4. Measurement errors, definition and classification, systematic, incidental and excessive errors
5. Elimination and assessment of errors determination of error uncertainty
6. Measurement instruments, their divisions and characteristic features
7. Measurement methods, direct and indirect methods
8. The errors of indirect methods, other measurement methods
9. Metrological terms, calibration, validation
10. Deviations of shape, location, position and run out
11. Measurement transducers and the principles of determining their metrological characteristics
12. The rules of tolerance and part fit
Laboratory:
1. Inspection of measurement instruments
2. Indirect measurements
3. Drawing of static characteristic curves of measurement transducers
4. Measurements and the analysis of tolerances and fit, shaft-basis and hole-basis fits
5. Statistical analysis of measurement results
6. Verification of measurement instrument repeatability

Course topics

Teaching methods

Lecture: a multimedia presentation, illustrated by examples on the board and films.
Laboratory exercises: performing experiments, solving exercises, discussions, team work.

Bibliography

Basic
Jakubiec W., Zator S., Majda P.: Metrologia, PWE 2014
Jakubiec W., Malinowski J., Metrologia wielkości geometrycznych, Warszawa, WNT 2018
Arendarski J., Niepewność pomiarów, Warszawa, Instytut Metrologii i Systemów Pomiarowych
Politechniki Warszawskiej 2000
Paczyński P., Podstawy metrologii. Przewodnik do wykładów, ćwiczeń i laboratoriów, Wyd. Politechniki
Poznańskiej 2003
Specyfikacje geometrii wyrobów (GPS), red. Z. Humienny, Warszawa, Oficyna Wydawnicza Politechniki
Warszawskiej 2001
Humienny Z., Osana P.H., Tamre M., Weckenmann A., Blunt L., Jakubiec W.: Specyfikacje geometrii
wyrobów (GPS), podręcznik europejski, WNT, Warszawa 2004
Additional
Adamczak S., Makieła W., Metrologia w budowie maszyn. Zadania z rozwiązaniami, Kielce, Politechnika
Świętokrzyska 2001
Jezierski J., Analiza tolerancji i niedokładności w budowie maszyn, Warszawa, WNT 1994
Przewodnik ISO. Wyrażanie niepewności pomiaru, Warszawa, GUM 1999
Taylor J. R., Wstęp do analizy błędu pomiarowego, Warszawa, PWN 1995
Malinowski J.: Pasowania i pomiary. WSz i Pedag. Wyd. 3, Warszawa 1993

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	65	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,00