# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of metrology

## Course

Field of study
Education in Technology and Informatics

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

## Number of hours

| Lecture | Laboratory classes | Other (e.g. online) |
|---|---|---|
| 26 | 30 | |
| Tutorials | Projects/seminars | |

## Number of credit points

4

## Lecturers

Responsible for the course/lecturer:
dr inż. Lidia MARCINIAK - PODSADNA

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Wydział Inżynierii Mechanicznej

Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

## Prerequisites

Knowledge in the field of mathematical analysis and statistics, technical drawing and machine parts. Willingness to acquire new knowledge and skills. The ability to think logically and use information obtained from various sources.

## Course objective

Learning the basic concepts of measurement techniques. Becoming familiar with instruments and measuring methods used in mechanical engineering. Acquiring the ability to calculate and select tolerances and the fit symbol for holes, shafts and threads. Gaining knowledge about measurement methods, error calculation and calculating the uncertainty of direct and indirect measurement.

## Course-related learning outcomes

Knowledge

1. The student knows the SI system of measurement units - [K_W01, K_W03]

2. The student knows definitions and classification of individual types of errors, their elimination or estimation - [K_W03, K_W10]

3. The student knows the statistical methods of elaborating the measurement results - [K_W10, K_W25]

4. The student knows the rules of estimating the measurement uncertainty - [K_W10, K_W25]

5. The student knows the basic measuring equipment used to measure machine parts - [K_W10, K_W11

Skills

1. The student is able to perform checking a measuring instrument according to the instructions - [K_U13]

2. The student is able to calculate measurement uncertainty for direct and indirect measurements - [K_U01]

3. The student is able to determine the measurement uncertainty of an instrument using the A and B method - [K_U04]

4. The student is able to make a statistical analysis of the measurement results - [K_U01, K_U13]

5. The student is able to analyze the tolerances of the manufactured products and knows the rules of fitting parts - [K_U01, K_U13]

Social competences

1. Is aware of the importance of carrying out correct measurements of machine parts - [K_K01]

2. Can defend the metrological calculations made - [K_K02]

3. Can independently develop knowledge in the field of metrology - [K_K04]

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Final test

Laboratory: Credit based on an oral or written answer concerning the content of each performed laboratory exercise and a written report. To obtain a credit, all exercises must be passed.

## Programme content

Lecture:

Measurement theory, measurement and its essence, measurement result, methods, types and methods of measurement, SI system of measurement units, definition of a meter, etalons, standards of length and angle measurements, gauge blocks, measuring rolls and balls, angle plates, angles, pattern

hierarchy, measurement errors, definition and classification, systematic, random and excessive errors, elimination and estimation of errors, determination of measurement uncertainty, statistical analysis of measurement results, measurement tools, their division and characteristics, measurement methods, errors of indirect methods, caliper, micrometric instruments, sensors, length gauges, altimeters, microscopes, projectors, systems of tolerances and fits of machine parts, measurements of angles and cones. Basics of the coordinate technique.

## Teaching methods

1. During the lecture, the theory is supported by examples. The lecture is conducted in an interactive way, questions

2. Laboratory exercises: conducting experiments, solving problems, discussion.

## Bibliography

Basic

1. Jakubiec W., Malinowski J.: Metrologia wielkości geometrycznych. WNT, Warszawa, 2018

2. Białas S. Humienny Z, Kiszka K.: Metrologia z podstawami specyfikacji geometrii wyrobu (GPS), Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2014

3. Paczyński P.: Metrologia Techniczna. Przewodnik do wykładów, ćwiczeń i laboratoriów, wyd. Politechniki Poznańskiej, Poznań 2003

4. Humienny Z. i inni: Specyfikacje geometrii wyrobów (GPS), Wydawnictwa Naukowo-Techniczne, Warszawa, 2004.

5. Adamczak S, Makieła W., Metrologia w budowie maszyn, WNT, Warszawa, 2010

Additional

1. Piotrowski J., Podstawy metrologii, PWN, Warszawa, 1979

2. Sydenham P.H., Podręcznik metrologii, t1, Wyd. Kił, Warszawa, 1988

3. Arendarski J. Niepewność pomiarów, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2003

4. Hagel R., Zakrzewski J., Miernictwo dynamiczne, WNT, Warszawa, 1984.

5. Ratajczyk E., Woźniak A., Współrzędnościowe systemy pomiarowe, Wydawnictwo Politechniki Warszawskiej, 2016

6. Tomasik J., Arendarski J., Gliwa – Gliwiński J., Jabłoński Z., Ratajczyk E., Żebrowska – Łucyk S., Sprawdzanie przyrządów do pomiaru długości i kąta, OWPW, 2009

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 100 | 4,0 |
| Classes requiring direct contact with the teacher | 35 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 62 | 2,0 |

[1] delete or add other activities as appropriate