



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Technical mechanics [S1MiBM2>MeT2]

### Course

Field of study

Mechanical Engineering

Year/Semester

2/4

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

4,00

### Coordinators

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### Lecturers

### Prerequisites

Knowledge of mathematical statistics, basic metrology, and the fundamentals of technological processes, technical drawing, and CAD systems. Willingness to acquire new knowledge and skills. Ability to think logically and use information obtained from various sources.

### Course objective

To become acquainted with measuring systems used in mechanical engineering. To acquire knowledge of measurement systems operating on the basis of coordinate measurement technology, their types and areas of application, as well as ways to supervise measurement systems. To become aware of the variety of measurement tasks in modern industry and the range of information that can be obtained on the basis of measurement.

### Course-related learning outcomes

Knowledge

1 The student is able to characterize measurement systems used in mechanical engineering.

2. The student is able to characterize the basic devices included in measuring systems.

## Skills

1. The student is able to select a measurement system for a measurement task.
2. The student is able to develop a measurement strategy in a basic level.
3. The student is able to process and analyze measurement data.
4. The student is able to identify sources of coordinate measurement errors and is able to eliminate them.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written examination in the form of a test.

Laboratory: Credit awarded on the basis of an oral or written response covering the content of each laboratory exercise performed and the submitted reports. In order to obtain credit, all exercises must be passed.

## Programme content

The course content covers issues related to the selection of a measurement system for verifying the dimensional conformity of a component with the requirements specified in the technical documentation. It also includes the fundamentals of coordinate metrology and the characteristics of measurement systems based on this technique, taking into account their classification with respect to the sampling method (contact and non-contact techniques) as well as the measurement scale (macro-, meso-, and micro-scale).

## Course topics

Lecture:

1. Basic issues of metrology - definition and structure of the measurement system.
2. Measuring systems performing tasks in the field of mechanical engineering.
- 3 Introduction to coordinate measuring technique.
- 4 Contact coordinate measuring systems.
5. Transducers and measuring heads in coordinate measuring technology.
6. Optical coordinate measuring systems.
7. Form and position deviation measurements - introduction to GPS and GD&T.
8. Analysis of measuring systems - MSA.

Laboratory:

1. Measurements on a coordinate measuring machine.
2. Measurements on optical measuring scanner 1.
3. Measurements on optical measuring scanner 2.
4. Thermal imaging measurements.
5. Measurements on CT.
6. Analysis of measurement data.
7. Surface roughness measurements 1.
8. Surface roughness measurements 2.
9. Multisensor measurements.
10. Supervision of control and measurement equipment 1.
11. Supervision of control and measurement equipment 2.
12. Supervision of control and measurement equipment 3.

## Teaching methods

Lecture: multimedia presentation illustrated with examples given on the board and videos.

Laboratory: performing experiments, solving tasks, discussion, teamwork.

## Bibliography

Basic

Ratajczyk E., Woźniak A.: Współrzędnościowe systemy pomiarowe, Warszawa 2016

Sładek J.: Dokładność pomiarów współrzędnościowych, Kraków 2013

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

Humienny Z., Osana P.H., Tamre M., Weckenmann A., Blunt L., Jakubiec W.: Specyfikacje geometrii wyrobów (GPS), podręcznik europejski, WNT, Warszawa 2004

Jakubiec W., Zator S., Majda P.: Metrologia, PWE 2014

Normy ISO 10360 - części 1-13

Wieczorowski M.: Wykorzystanie analizy topograficznej w pomiarach nierówności powierzchni, Wydawnictwo Politechniki Poznańskiej, 2009

Additional

Ratajczyk E.: Współrzędnościowa technika pomiarowa. Maszyny i roboty pomiarowe, Warszawa 1994.

Ratajczyk E.: Współrzędnościowa technika pomiarowa, Warszawa 2005. Jezierski J., Analiza tolerancji i niedokładności w budowie maszyn, Warszawa, WNT 1994

Białas S., Humienny Z., Kiszka K.: Metrologia z podstawami specyfikacji geometrii wyrobów (GPS) WPW 2014

Przewodnik ISO. Wyrażanie niepewności pomiaru, Warszawa, GUM 1999

Arendarski J., Niepewność pomiarów, Warszawa, Instytut Metrologii i Systemów Pomiarowych Politechniki Warszawskiej 2000

Specyfikacje geometrii wyrobów (GPS), red. Z. Humienny, Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej 2001

Pawlus P.: Topografia powierzchni: pomiar, analiza, oddziaływanie, Oficyna Wydawnicza Politechniki Rzeszowskiej, 2005

### Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00