



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Measurement systems

Course

Field of study

Management and production engineering

Area of study (specialization)

Quality management

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture

15

Tutorials

Laboratory classes

15

Projects/seminars

Other (e.g. online)

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Knowledge of basics of metrology and basics of technological processes, technical drawing and the basics of CAD systems. Willingness to acquire new knowledge and skills. The ability to think logically and use information obtained from various sources.



Course objective

Getting to know measuring systems used in mechanical engineering. Acquiring knowledge about measuring systems based on coordinate measuring technique, their types and areas of applications. Awareness of the variety of measurement tasks in modern industry and the scope of information that can be obtained on the basis of measurement.

Course-related learning outcomes

Knowledge

1. The student is able to characterize the measurement systems used in mechanical engineering [K_W14]
2. The student is able to characterize basic devices included in the measurement systems. [K_W14]

Skills

1. Student is able to select the measurement system for the measurement task. [K_U20]
2. Student is able to develop a measurement strategy on the basic level. [K_U20]
3. Student is able to develop and analyze measurement data. [K_U20]
4. Student is able to determine the sources of coordinate measurement errors and is able to eliminate them. - [K_U20]

Social competences

1. Student is able to work in a group. - [K_K03]
2. Student is aware of the role of measurement systems in the modern economy - [K_K07]
3. Student can independently develop knowledge in the field of metrology – [K_K04, K_K05]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written test

Laboratory: crediting on the base of an oral or written answer concerning the content of each performed laboratory exercise and preparation of reports. In order to pass the classes, all exercises must be completed.

Programme content

Lecture:

1. Definition, structure and tasks of measurement system
2. Measurement systems that perform tasks in the area of mechanical engineering.
3. Classification and applications of measuring devices.



4. The essence of the coordinate technique in machine parts measurements.
5. Coordinate measuring machines, classification, principle of operation.
6. Optical measuring systems.
7. Measurements of form deviations.
8. Measurements of surface roughness and topography.
9. Industrial computed tomography.

Lab:

1. Measurements on a coordinate measuring machine - manual measurements.
2. Measurements on an optical measuring scanner
3. Measurements on a computed tomography
4. Analysis of measurement data
5. Measurements on multisensor machine

Teaching methods

Lecture: multimedia presentation illustrated with examples given on the whiteboard and films.

Laboratory exercises: performing experiments, case study, discussion, working in a group.

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

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

Breakdown of average student's workload

| | Hours | ECTS |
|---|-------|------|
| Total workload | 50 | 2,0 |
| Classes requiring direct contact with the teacher | 30 | 1,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) ¹ | 20 | 1,0 |

¹ delete or add other activities as appropriate