COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metrology and measurement systems [N1ZiIP2>MiSP2]

Course

Field of study
Management and Production 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
part-time

Requirements
compulsory

Number of hours

Lecture
8

Laboratory classes
16

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

Lecturers

Prerequisites

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

Course objective

To become familiar 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 can select a measurement system for a measurement task.

2. The student is able to develop a basic measurement strategy.
3. The student is able to process and analyze measurement data.
4. The student is able to identify the sources of coordinate measurement errors and is able to eliminate them.

Social competences:
1 The student is able to cooperate in a group.
2. The student is aware of the role of measurement systems in modern economy.
3. The student is able to independently develop knowledge in the field of metrology.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Written or oral pass.
Laboratory: Passing grade on the basis of an oral or written answer on the content of each laboratory exercise performed and the reports completed. All exercises must be passed to receive credit for the class.
Assignment of grades to percentage ranges of results: <90-100> very good; <80-90) good plus; <70-80) good; <60-70) satisfactory plus; <50-60) satisfactory; <0-50) unsatisfactory.

Programme content

The theory of coordinate measurement technique. The different ways of collecting measurement data and the associated errors. Classification of WTP-based measurement systems. Basics of interpretation of GPS and GD&T drawing signs. Elements of developing a strategy for measuring geometric features of spatial elements. Evaluation of the appropriateness of measurement sytems for use in specific industrial applications.

Course topics

Lecture:
1. Basic issues of metrology - definition and structure of the measurement system.
2. Measurement systems performing tasks in the field of mechanical engineering.
3 Introduction to coordinate measuring technology.
4 Contact coordinate measuring systems.
5. Systems and measuring heads in coordinate measuring technology.
6.Optical coordinate measuring systems.
7.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. Thermographic measurements.
5. Measurements on a computed tomography scanner.
6. Measurement data analysis 1.
7. Measurement data analysis 2.
8. Surface roughness measurements 1.
9. Surface roughness measurements 2.
10. Multisensor measurements.
11. Supervision of inspection and measurement devices 1.
12. Supervision of inspection and measurement devices 2.
13. Supervision of inspection and measurement devices 3.
14. Measurement strategy.

Teaching methods

Lecture: presentation with elements of modern teaching methods, such as PBL, 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	24	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	76	3,00