COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metrology and measurement systems [N1ZiIP2>MiSP1]

Course

Field of study
Management and Production Engineering

Year/Semester
1/2

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
8

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

Lecturers

Prerequisites

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

Course objective

To learn the basic concepts of measurement techniques. To become familiar with measuring instruments and methods used in mechanical engineering. To acquire the ability to calculate and select tolerances and fit symbols for holes, shafts and threads. To acquire knowledge of measurement methods, error calculus and calculation of uncertainty in direct and indirect measurement.

Course-related learning outcomes

Knowledge:
1. The student knows the SI system of units
2. The student knows the definitions and classification of various types of errors their elimination or estimation
3. The student knows statistical methods of processing measurement results
4. The student knows the principles of estimating measurement uncertainty
5. The student knows basic measurement equipment used to measure machine parts

Skills:
1. The student is able to perform the operation of checking the measuring instrument according to the instructions
2. The student is able to calculate the value of uncertainty for direct and indirect measurements
3. The student is able to determine the uncertainty of measurement of an instrument by method A and B
4. The student is able to perform statistical analysis of measurement results
5. The student is able to analyze the tolerances of manufactured products and knows the principles of fitting parts

Social competences:
1. The student is aware of the importance of performing correct measurements of machine parts
2. The student is able to defend the metrological calculations made
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.
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.
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.

Programme content

Theory of measurement, SI system of measurement units, standards and their hierarchy, measurement errors - definition and classification, elimination and estimation of errors, determination of measurement uncertainty, statistical analysis of measurement results, measurement tools, their classification and characteristics, measurement methods, tolerance and fit systems of machine parts.

Course topics

Lecture:
1. The essence of measurement and its result, methods, types and manner of measurement, SI system of units.
2. Standards of measurement, measuring instruments.
3. Errors in measurement - sources of errors, idefinition and classification.
4. Uncertainty of measurement.
5. System of tolerances and fits.
6. Measurement of angles and cones.
7. Errors of form and position.
Laboratory:
1. Inspection of measuring instruments.
2. Indirect measurements.
3. Statistical analysis of measurement results.
4. Repeatability test of measuring instrument.
5. Measurement of external and internal dimensions.
6. Measurement of threads.

Teaching methods

In the lecture the theory is supported by examples. The lecture is conducted using modern teaching methods such as PBL.
Laboratory: performing experiments, solving tasks, discussion, teamwork.

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	50	2,00
Classes requiring direct contact with the teacher	16	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	34	1,50