COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metrology and measurement systems [N1Mech2>MTiSP]

Course

Field of study
Mechatronics

Year/Semester
3/5

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
8

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

Knowledge: knowledge of mathematical statistics, technical drawing and machine parts Skills: logical thinking, using information from the library and the Internet Social competencies: understanding the need for learning and acquire new knowledge

Course objective

Adapting basic concepts from measurement techniques. Get acquainted with measuring instruments and methods and measuring systems used in machine construction. Acquire the ability to calculate engineering tolerances of inner and outer features of cylinder bores, drilled holes, linear and precision shafts, pistons, thread etc. Ability to estimate uncertainty of measurement. A and B type uncertainty estimates.

Course-related learning outcomes

Knowledge:
Student knows basic concepts of measurement techniques.
Student knows measurement methods and measuring systems used in machine construction.
Student knows basic measuring equipment used for measuring machine parts.

Skills:
Student is able to calculate and select tolerances and symbols for holes and shafts, threads and other

machine parts.
Student knows the hierarchy of standards and can choose measuring instruments for measuring machine parts.
Student is able to calculate the uncertainty of measurements using the A and B method.
Student is able to calculate the uncertainty for indirect measurements.

Social competences:
Student is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its environmental impact and the resulting responsibility for its decisions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Passing on the basis of an examination (exam), conducted at the end of the semester - 51% points: ≥51% (3.0), >60% (3.5), >70% (4.0), >80% (4.5), >90% (5.0)).
Laboratory: Passed on the basis of a written answer in the scope of content. Performed the laboratory exercises according to the program established by the teacher with a positive grade of the reports on the six exercises prepared according to the subject matter
Classes: Passing on the basis of a colloquiums

Programme content

Measurement theory.
Principles of accuracy analysis of measurement results.
Standards for length and angle measurement.
Measurement methods and techniques, as well as measurement tools used in the measurement of machine components.
Tolerances and fits of machine parts.
Basics of coordinate measurement techniques.

Course topics

Lecture:
1.Measurement theory, measurement result, estimating uncertainty from measurement
2. Etalons, standards of length and angle, gauge block, angular gauge block, hierarchies of standards
3. Measurement instruments of length and angle measurements - calipers, micrometers, sensors
4. Tolerance and fit system (shaft and holes measurement)
5. Measurement of external and internal threads
6. Methods of measurement for angles and cones
7. Measurements of shape deviations and position, measurements of surface roughness
8. Introduction to CMM
Laboratory:
1. Tolerances and fits.
2. Calculation of measurement uncertainty.
3. Checking measuring instruments (micrometer).
4. Contact thread measurements.
5. Statistical analysis of the measurement results.
6. Measurement of shape deviations.
7. Introduction to the coordinate technique.
Classes:
Tolerance and fit system, estimating uncertainty from measurement

Teaching methods

Lecture: presentation illustrated with examples given on the blackboard, solving problems.
Classes: solving problems on the board.
Laboratory: practical exercises, teamwork.

Bibliography

Basic:
Paczyński P.: Metrologia techniczna. Przewodnik do wykładów ćwiczeń i laboratoriów. Wyd. Zakład Metrologii i Systemów Pomiarowych, Politechnika Poznańska, Poznań 2003.
Adamczak S., Makieła W.: Metrologia w budowie maszyn. Zadania z rozwiązaniami. Politechnika Świętokrzyska, Kielce 2001.
Arendarski J.: Niepewność pomiarów. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
Humienny Z., Osanna P.H., Tamre M., Weckenmann A., Blunt L., Jakubiec W.: Specyfikacja geometrii wyrobów (GPS). WNT, Warszawa 2004.
Jakubiec W.: Malinowski J.: Metrologia wielkości geometrycznych. WNT, Warszawa 1999.

Additional:
Jezierski J.: Analiza tolerancji i niedokładności w budowie maszyn. WNT, Warszawa 1994.
Malinowski J.: Pomiary długości kąta. Wyd. Szkol. i Pedag., wydanie 3-cie, Warszawa 1993.Malinowski J.
Jakubiec W., Płowucha W.: Pomiary gwintów w budowie maszyn, WNT, 2009
Ratajczyk E.: Współrzędnościowa technika pomiarowa, Wyd. Politechniki Warszawskiej, 2005
Pawlus P.: Topografia powierzchni: pomiar, analiza, oddziaływanie, Oficyna Wydawnicza Politechniki Rzeszowskiej, 2005
Sładek J.: Dokładność pomiarów współrzędnościowych, Politechnika Krakowska, 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	26	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	49	2,00