



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Metrology and measurement systems

Course

Field of study

Mechatronics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

part-time

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

Number of hours

Lecture

12

Laboratory classes

12

Other (e.g. online)

0

Tutorials

12

Projects/seminars

0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Ph.D. Radomir Majchrowski

Responsible for the course/lecturer:

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FACULTY OF MECHANICAL ENGINEERING

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 - K_W13.

Student knows measurement methods and measuring systems used in machine construction - K_W13.

Student knows basic measuring equipment used for measuring machine parts - K_W13.

Skills

Student is able to calculate and select tolerances and symbols for holes and shafts, threads and other machine parts - K_U17

Student knows the hierarchy of standards and can choose measuring instruments for measuring machine parts - K_U17

Student is able to calculate the uncertainty of measurements using the A and B method - K_U17.

Student is able to calculate the uncertainty for indirect measurements - K_U17.

Social competences

1 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 - K_K02

Student can cooperate and work in a group - K_K03

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Passing on the basis of an examination (test), conducted at the end of the semester.

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

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 and optical 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.

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

Jeziński J.: Analiza tolerancji i niedokładności w budowie maszyn. WNT, Warszawa 1994.

Malinowski J.: Pomiary długości kąta. Wyd. Szkol. i Pedagog., 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

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

Breakdown of average student's workload

| | Hours | ECTS |
|---|-------|------|
| Total workload | 100 | 4,0 |
| Classes requiring direct contact with the teacher | 65 | 3,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) ¹ | 35 | 1,0 |

¹ delete or add other activities as appropriate