COURSE DESCRIPTION CARD - SYLLABUS

Course name
Object digitization [S2MiBM2-INPR>DO]

Course

Field of study
Mechanical Engineering

Year/Semester
2/3

Area of study (specialization)
Production Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student should have knowledge of technical metrology, measurement systems, coordinate measurement technique, technical drawing and the basics of CAD systems. The student should show a willingness to acquire new knowledge and skills. Ability to think logically and use information obtained from various sources. The student should understand the needs of learning and acquiring new knowledge.

Course objective

Familiarization with digitization techniques of objects realized at various scales and using various measurement techniques. Obtaining data on scales from macro to nano, allowing the development of a 2D or 3D digital image of the measured object. Awareness of the role of modern metrological devices in Industry 4.0, their impact on manufactured products and the ability to correctly select measurement solutions aimed at obtaining metrologically correct results.

Course-related learning outcomes

Knowledge:
1. The student knows the principles of selecting devices for the correct implementation of a measurement task.

2. The student knows how to process measurement data to obtain a digital model.
3. The student knows the limitations of individual measuring devices

Skills:
1. The student is able to select a measurement system for the measurement task.
2. The student is able to develop a basic measurement strategy.
3. The student is able to prepare and analyze measurement data.
4. The student is able to determine the sources of 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 techniques and digitalization in the modern economy.
3. Is able to independently develop knowledge in the field of metrology of geometric quantities

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Assessment based on a colloquium consisting of scored questions (pass in case of obtaining 51% of points: ≥51% (3.0), >60% (3.5), >70% (4.0), >80% (4.5), >90 % (5.0)) carried out at the end of the semester.
Laboratory: Assessment on the basis of an oral or written answer regarding the content of each laboratory exercise performed and preparation of a report. To pass the course, all exercises must be completed.

Programme content

Lecture:
1. Digitization of objects - challenges on various scales.
2. Geometric structure of the surface - parameters applicable at various scales.
3. Contact measuring devices on a macro scale
4. Contact measuring devices on a micro scale
5. Nano scale contact measuring devices
6. Non-contact measuring devices on a macro scale
7. Non-contact measuring devices on a micro scale
8. Non-contact measuring devices on the nano scale
9. 2D data processing
10. 3D data processing
11. Reverse engineering
12. Assessment of the metrological correctness of the measurement process
Laboratory:
1. Contact measurements - 2D and 3D on a macro scale.
2. Contact measurements - 2D and 3D on a micro scale.
3. Analysis and processing of measurement data - contact measurement
4. Non-contact 3D measurements on a macro scale.
5. Non-contact 3D measurements on a micro scale.
6. Analysis and processing of measurement data - optical measurement

Course topics

none

Teaching methods

Lecture: presentation illustrated with examples given on the blackboard, solving problems.
Laboratory: practical exercises, team work

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

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
Krzysztof Kiszka, Sławomir Białas, Zbigniew Humienny: Metrologia z podstawami specyfikacji geometrii wyrobów (GPS) OWPW 2021
Specyfikacje geometrii wyrobów (GPS), red. Z. Humienny, Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00