COURSE DESCRIPTION CARD - SYLLABUS

Course name
Reverse engineering

Course

Field of study
Mechanical engineering
Area of study (specialization)
Computerization and robotization in manufacturing
Level of study
Second-cycle studies
Form of study
full-time
Year/Semester
2/3
Profile of study
general academic
Course offered in
polish
Requirements
elective

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
Tutorials
Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

The student starting this course should have knowledge in the field of technical metrology, technical drawing and machine parts and CAD systems, the basics of technology product development.

Course objective

Getting to know the essence of reverse engineering, modern techniques, measuring instruments used in the process of reverse engineering, the basis of coordinate measuring techniques both tactile and optical, CAD and CAM software, GPS analysis (Geometric Product Specification), solid and surface design based on the obtained measurement data, design methodology and errors resulting from the process of reconstructing the shape of the tested element and from postprocessing of measurement data to the full form of digital mapping of the workpiece shape, coordinate tactile and optical measurements and inspection using the developed CAD model of the tested element.

Course-related learning outcomes

Knowledge

1. Student has detailed knowledge of construction and engineering graphics, including elements of machine science and engineering graphics.
2. Student has knowledge in the field of computer-aided machine design on the levet that enables mapping and dimensioning of machine elements; machine design with the use of CAD.
3. Stident has knowledge in the field of metrology and measurement systems including the basics of measurement theory, measurement methods and tools to assess the accuracy of dimensions, methods of assessing the geometric structure of the surface, coordinate measurement technique, measurements of machine parts of complex shape applied to use measuring equipment, metrology workshop and methods of estimating measurement errors.

Skills

1. Student is able to select a measuring device for a measuring task.
2. Student is able to develop a measurement strategy in the basic level.
3. Student is able to develop and analyze the measurement data.
4. Student is able to develop documentation for the implementation of an engineering task in the field of mechanics and machine construction.

Social competences

1. Student is able to work in a group.
2. Student is aware of the role of modern, advanced measurement systems in the modern economy

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: Assessment based on a written test.

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 exercises prepared according to the subject matter. In order to get a credit for the laboratories, all exercises must be passed.

Programme content

Lecture:

1. The essence of reverse engineering.
2. Basics of coordinate measuring technique.
3. Optical coordinate measuring systems.
4. CAD software supporting geometry reproduction.
5. Shape and position tolerances.
6. Accuracy of measurement systems used in reverse engineering.
7. Application of reverse engineering in mechanical engineering and plastics processing.
8. Application of reverse engineering in medicine.

Lab:

1. Analysis of the element geometry with the focus on determining the critical geometrical features.
2. Measurement of an element on a coordinate measuring machine/measuring scanner/CT.
3. Development of a mathematical model of the element on the basis of measurements on a CMM.
4. Comparison of measurement results, error analysis and generation of models for further processing.
5. Printing elements on a 3D printer, measurements and comparison with primary models.
6. Analysis of the results of inspection measurements.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.
2. Laboratory exercises: performing the tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Adamczak S., Pomiary geometryczne powierzchni: zarysy kształtu, falistość i chropowatość, WNT, Warszawa, 2008.
2. Białas S., Humienny Z., Kiszka K., Metrologia z podstawami specyfikacji geometrii wyrobów (GPS), Wyd. OWPW, Warszawa, 2014.
3. Chlebus E., Techniki komputerowe CAx w inżynierii produkcji, WNT, Warszawa, 2000.
4. Jakubiec W., Malinowski J., Metrologia wielkości geometrycznych, WNT, Warszawa, 2020.
5. Jakubiec W., Zator S., Majda P., Metrologia, PWE, Warszawa, 2014.
6. Ratajczyk E., Woźniak A., Współrzędnościowe systemy pomiarowe,.Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2016.
7. Zawada J., Metrologia wielkości geometrycznych, Wyd. Politechniki Łódzkiej, Łódź, 2011.

Additional

1. S. Tumański, Technika pomiarowa. WNT, Warszawa 2007.
2. Zięba A., Analiza danych pomiarowych w naukach ścisłych i technice, Wyd. PWN. Warszawa, 2014.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate