COURSE DESCRIPTION CARD - SYLLABUS

Course name
Data analysis in production engineering [S1ZiIP2>ADwIP]

Course

Field of study
Management and Production Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge of mathematics and probability. Has the ability to think logically and to perform basic mathematical calculations. Is aware of the need for teamwork, learning and acquiring new skills and knowledge. Student mastered basic computer operation.

Course objective

The aim of the course is to provide students with the basics of knowledge in the field of data analysis methods in engineering research, which includes methods for data description and presentation as well as their analysis and developing the skills of its practical application in solving specific tasks and engineering problems.

Course-related learning outcomes

Knowledge:
1. Knows the basic definitions and concepts in the field of engineering statistics (can name the population, sample, feature, define basic statistical measures describing the sample and population, probability distribution and related parameters, knows the basic distributions for discrete and continuous features).

2. Has knowledge of interval estimation (can define confidence intervals for population parameters: expected value, variance, fraction).
3. Has knowledge of verifying parametric hypotheses (can define a research problem and design a study to verify statistical hypotheses, is aware of the mistakes he may make in this process).
4. Has basic knowledge of linear regression and correlation.

Skills:
1. Can describe a random sample using the known statistical measures and visualize the results of the sample using the known graphical methods. He can apply these skills in solving engineering problems.
2. Can determine the probability of certain events using the known theoretical probability distributions describing the features shaped in the manufacturing processes. Is able to use for this purpose both formulas of probability distribution functions and uses statistical tables. He applies these skills on examples embedded in engineering issues.
3. Can verify hypotheses regarding population parameters (expected value, variance, fraction) and compare two populations in terms of equality of these parameters. Can relate acquired skills to real engineering problems arising in industrial practice.
4. Is able to examine the relationship of two phenomena and express the strength of this relationship. Is able to develop a linear regression model describing the relationship between two variables and assess its quality. He uses this skills in engineering issues.
5. Is able to solve presented problem: starting from naming the population, determining its size, specifying the size of the sample, the method of selecting elements for the sample, through the selection of analysis tools, and ending with inference. The examples relate to real problems that can be encountered in industrial practice.
6. Is able to conduct data analysis process with the use of chosen IT tools.

Social competences:
1. Is aware of the impact of conclusions from statistical analyzes on engineering decisions.
2. Is aware of the quality of data and statistical conclusions and is sensitive to any manipulation in statistical inference.
3. Is aware of the role of statistical analyzes in engineering activities.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit based on an exam, carried out at the end of the semester (the treshold of passing is 50%).
Exercises: credit is given on a test, carried out at the end of the semester (the treshold of passing is 50%).
Laboratories: credit is based on partial grades from groups of laboratories (the treshold of passing is 50%.
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.
Students are informed about test schedule at the first meeting.

Programme content

Lectures:
1. Methods of describing and presenting data from engineering research.
2. Methods for assessing risk and probability in manufacturing processes.
3. Methods of estimation and inference about manufacturing processes and their assessment.
4. Methods for assessing the degree of relationship between product or process features.
5. Introduction to information technology.
6. Computer hardware.
7. System software and application software.
8. Algorithm development and programming.
9. Communication, data storage and collaboration using information technology.

Course topics

Lecture:

1. Methods of describing and presenting data from engineering research (descriptive statistics - statistical measures from sample and population, graphical methods of data presentation - histogram, boxplot).
2. Methods for assessing risk and probability in manufacturing processes (probability distributions of continuous and discrete random variables - binomial, Poisson and normal distribution).
3. Methods of estimation and inference about manufacturing processes and their assessment (confidence intervals for mean and standard deviation, statistical hypotheses testing for mean).
4. Methods for assessing the degree of relationship between product or process features (correlation and linear regression).
5. Introduction to programming.
6. Visual Basic - introduction and basic definitions.
7. Integrated Development Environment and data storage.
8. Basic application components.
9. Language syntax and basic functions.
10. Customizing the application using Visual Basic for Applications.
11. Applying information technology in science and technology. Digital representation of information.
12. Computer hardware.
13. System and utility software. Methods of description of algorithms. Correctness of the algorithm. Data structures, operations on data.
14. Basic numerical and graphical algorithms.
Exercises:
They rely on the team or individual use of knowledge of the subject provided in the lecture in solving engineering tasks and problems.
Laboratories:
Microsoft Excel:
Basic concepts (worksheet, sheet, cell); Methods of moving around the sheet; Entering and editing data; Undo/Redo Commands; Inserting, deleting and copying sheets; Inserting and deleting rows and columns; Data hiding; Using help; Basic knowledge about formulas; Types of references (relative, absolute, mixed); Creating and modifying simple formulas; Copying formulas; Formula inspection (tracking predecessors and dependencies); Basic functions (SUM, AVERAGE, MIN, MAX); Copying values; Conversion options (manual, automatic); Graphs and formatting.
Visual Basic:
Programming computational algorithms using Visual Basic.
Decision and iteration structures, written in Visual Basic.
Customizing the applications to specific needs using Visual Basic for Applications environment.

Teaching methods

Lecture, active participation in classes, consultations, computer classes.

Bibliography

Basic:
1. Aczel A.D., Statystyka w zarządzaniu, Wydawnictwo Naukowe PWN, Warszawa 2000.
2. Bobrowski D., Probabilistyka w zastosowaniach technicznych, WNT Warszawa 1986.
3. Hamrol A: „Zarządzanie jakością z przykładami”, PWN Warszawa 2017
4. Navidi W., Statistics for Engineers and Scientists, 6th Edition, McGraw-Hill Education, New York, 2021.

Additional:
1. Starzyńska W., Statystyka praktyczna, Wydawnictwo Naukowe PWN, Warszawa 2005.
2. Viking G.G., Statistical Methods for Engineers, Duxbury-Brooks/Cole, Pacific Grave, CA 1998.
3. Montgomery D.C. Introduction to Statistical Quality Control, Wiley 2008

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	77	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	73	3,00