



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Descriptive and elements of applied statistics [S1IZarz1E>SOzES]

### Course

Field of study

Engineering Management

Year/Semester

3/5

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

English

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

0

Other

0

Tutorials

30

Projects/seminars

0

### Number of credit points

4,00

### Coordinators

dr inż. Barbara Popowska

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### Lecturers

### Prerequisites

1. The student has knowledge of mathematics in the field covered by teaching at high school level and has the ability to use a calculator 2. The student has the ability to think logically, associate facts, analyze issues and correctly reasoning 3. The student is aware of the need to know the methods of data analysis when studying various subjects in the field of management engineering

### Course objective

The aim of the course is to thoroughly learn the methods of descriptive statistics and to gain the ability to apply acquired knowledge to analyze problems in various fields, including technical

### Course-related learning outcomes

Knowledge:

The student discusses basic concepts of descriptive statistics, including definitions of statistical population, statistical unit, and statistical feature, and distinguishes different measurement scales [P6S\_WG\_09].

The student presents the stages of statistical research, covering the goal, subject, and space of statistical research, statistical observation, and the creation of statistical series [P6S\_WG\_16].

The student performs an analysis of classical and positional measures of location and measures of variability of the studied feature, including standard deviation and variance [P6S\_WG\_17].  
The student presents principles of analyzing the co-dependence of two features, including the use of correlation diagrams and correlation tables [P6S\_WG\_18].

#### Skills:

The student applies statistical methods to analyze and evaluate processes in organizations, including creating histograms, frequency polygons, and frequency curves [P6S\_UW\_01].

The student uses forecasting techniques based on statistical data, applying linear regression models [P6S\_UW\_02].

The student analyzes statistical data using measures of correlation, including Pearson's linear correlation coefficient and Spearman's rank correlation [P6S\_UW\_07].

The student performs statistical experiments and interprets the results in the context of management [P6S\_UW\_09].

#### Social competences:

The student assesses cause-and-effect relationships in statistical data and applies them in the managerial decision-making process [P6S\_KK\_02].

The student develops projects using statistical analyses, considering legal, economic, and organizational aspects [P6S\_KO\_03].

The student emphasizes professionalism and ethics in the analysis and application of statistical data in management [P6S\_KR\_01].

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written final test

Tutorials - one test + activity + presentation of own research results on selected statistical issues.

Assessment criteria:

below 50% - 2,0 50%-59% - 3,0 60%-69% - 3,5

70%-79% - 4,0 80%-89% - 4,5 90%-100% - 5,0

### Programme content

BASIC CONCEPTS OF DESCRIPTIVE STATISTICS

STAGES OF STATISTICAL RESEARCH

CLASSICAL AND POSITIONAL MEASUREMENTS OF THE LOCATION OF THE INVESTIGATED FEATURE.

CLASSICAL AND POSITIONAL MEASUREMENTS OF VARIABILITY OF THE INVESTIGATED TRAITS

CLASSICAL, POSITIONAL AND CLASSICAL-POSITIONAL MEASUREMENTS OF THE ASYMETRY OF THE INVESTIGATED FEATURE

MEASURES OF CONCENTRATION OF THE RESEARCH

ANALYSIS OF THE INTERDEPENDENCE OF TWO FEATURES AND MEASURE OF CORRELATION

REGRESSION ANALYSIS

### Course topics

Lecture :

PRELIMINARIES (populations, observations and samples, statistical characteristics and their classification, measure scales).

STATISTICAL RESEARCH STAGES (aim, subject and space of statistical research, statistical observations and samples, statistical series and their types, statistical tables, graphs - histograms, boxplot, box-and-whisker plot).

MEASURES OF CENTRAL TENDENCY (outliers, arithmetic mean (AM), geometric mean (GM), harmonic mean (HM), relationship between AM, GM and HM, mode, median, quartiles, other quantiles).

MEASURES OF DISPERSION (average deviation, variance, standard deviation, classic coefficient of variation, range, interquartile range, interquartile deviation, order coefficient of variation).

MEASURES OF SKEWNESS (negative skew, positive skew, measures of skewness, coefficient of asymmetry, order measure of skewness, order measure of asymmetry, central moments of third order, sample skewness).

MEASURES OF CONCENTRATIONS (kurtosis, excess, Gini coefficient of concentration, Lorenz curve).

MEASURES OF CORRELATION FOR TWO VARIABLES (correlation series, correlation diagram, correlation

table, covariance, Pearson's correlation coefficient, Spearman's and Kendall's rank correlation coefficients).

REGRESSION ANALYSIS (linear regression model, least squares method, nonlinear regression, multiple regression).

Tutorials:

PRELIMINARIES (populations, observations and samples, statistical characteristics and their classification, measure scales).

STATISTICAL RESEARCH STAGES (aim, subject and space of statistical research, statistical observations and samples, statistical series and their types, statistical tables, graphs - histograms, boxplot, box-and-whisker plot).

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REGRESSION ANALYSIS (linear regression model, least squares method, nonlinear regression, multiple regression).

## Teaching methods

Lecture - multimedial presentation + examples on the blackboard.

Tutorials - solving problems; discussion about obtained results

## Bibliography

Basic:

1. G.A.F. Seber, A. J. Lee, Linear regression analysis. John Wiley and Sons, 2003 (Mg 179960)
2. R. Johnson, Elementary statistics. Boston: Duxbury Press, 1984 (Mg 190139)
3. E. Wasilewska, Statystyka opisowa od podstaw. Podręcznik z zadaniami. Wydawnictwo SGGW, 2015.
4. E. Wasilewska, Statystyka matematyczna w praktyce. Wydawnictwo Difin, 2015. (księg. stud. E1, W 157580)
5. I. Bąk, I. Markowicz, M. Mojsiewicz, K. Wawrzyniak, Statystyka opisowa : przykłady i zadania. Wydawnictwo: CeDeWu, Warszawa 2015. (księg. stud. A2, W 157584)
6. W. Starzyńska, Statystyka praktyczna. Wydawnictwo Naukowe PWN, Warszawa 2012. (księg. stud. A2, W 146547)
7. M. Iwińska, B. Popowska, M. Szymkowiak, Statystyka opisowa. Wydawnictwo Politechniki Poznańskiej, 2011. (księg. stud. E1, W 130794)
8. J. Buga, H. Kassyk-Rokicka, Podstawy statystyki opisowej. Wydawnictwo: Vizja Press & IT, Warszawa 2008. (księg. stud. A2, W 119664)
9. M. Sobczyk, Statystyka. Wydawnictwo Naukowe PWN, Warszawa (1998 - księg. stud. A2, W 146934; 2007 - czytelnia)

Additional:

1. A. Witkowska, M. Witkowski, Statystyka opisowa w przykładach i zadaniach. Wydawnictwo Uczelni Państwowej Wyższej Szkoły Zawodowej im. Prezydenta Wojciechowskiego, Kalisz 2007. (księg. stud. A2, W 123957)
2. W. Regel, Ćwiczenia z podstaw statystyki w Excelu. Wydawnictwo Naukowe PWN, Warszawa 2007. (księg. stud. A2, W 121127)
3. A. Aczel, Statystyka w zarządzaniu : pełny wykład (przekł.: Zbigniew Czerwiński, Wojciech Latusek). Wydawnictwo Naukowe PWN, Warszawa 2006. (księg. stud. A3, W 90872)

### Breakdown of average student's workload

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