COURSE DESCRIPTION CARD - SYLLABUS

Course name
Descriptive statistics for engineers [S1IBiJ1>SOdl]

Course

Field of study
Safety and Quality Engineering

Year/Semester
1/2

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
15

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

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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:
1. Defines basic concepts of descriptive statistics, such as statistical population, statistical unit, statistical feature, and classifies statistical features according to the measurement scale [K1_W04].
2. Describes the stages of statistical research, including purpose, subject, and space of the study, and characterizes different types of series and statistical tables [K1_W04].
3. Explains the differences between classical and positional measures of location and variability of the

studied feature, including arithmetic mean, median, variance, and standard deviation [K1_W04].
4. Distinguishes measures of asymmetry and concentration of the studied feature, including skewness index, kurtosis coefficient, and Lorenz curve, and illustrates their application in data analysis [K1_W04].
5. Identifies and describes various measures of correlation and regression, including Pearson's and Spearman's correlation coefficients, and explains their application in the analysis of the interdependence of two features [K1_W11].

Skills:
1. Applies statistical methods to data analysis, using appropriate measures of location, variability, asymmetry, concentration, and correlation and regression to interpret the study results [K1_U04].
2. Prepares and presents results of statistical analysis, using tables, histograms, and frequency polygons, demonstrating the ability to critically analyze and synthesize information [K1_U01].
3. Analyzes and compares different statistical measures to assess variability, location, asymmetry, and concentration of the studied feature, using computer tools for data processing [K1_U04].

Social competences:
1. Recognizes and appreciates the importance of descriptive statistics in the analysis and interpretation of engineering data, developing the skill of continuous improvement in statistical methods [K1_K02].
2. Works as a team on research projects, using descriptive statistics to support engineering decisions, reflecting the ability to perceive causal relationships in achieving goals [K1_K01].

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%-64% - 3,0 65%-74% - 3,5
75%-84% - 4,0 85%-94% - 4,5 95%-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-
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regression).

Teaching methods

Lecture - multimedial presentation + examples on the blackboard.
Tutorials - solving problems; discussion about obtained results.

Bibliography

Basic:
1. E. Wasilewska, Statystyka opisowa od podstaw. Wydawnictwo SGGW, 2009.
2. M. Sobczyk, Statystyka opisowa. Wydawnictwo C.H.Beck, 2010.
3. I. Bąk, I. Markowicz, M. Mojsiewicz, K. Wawrzyniak, Statystyka opisowa : przykłady i
zadania.Wydawnictwo: CeDeWu, Warszawa 2015.
4. W. Starzyńska, Statystyka praktyczna. Wydawnictwo Naukowe PWN, Warszawa 2012.
5. M. Iwińska, B. Popowska, M. Szymkowiak, Statystyka opisowa. Wydawnictwo Politechniki
Poznańskiej, 2011.

Additional:
1. A. Witkowska, M. Witkowski, Statystyka opisowa w przykładach i zadaniach. Wydawnictwo Uczelni
Państwowej Wyższej Szkoły Zawodowej im. Prezydenta Wojciechowskiego, Kalisz 2007.
2. J. Buga, H. Kassyk-Rokicka, Podstawy statystyki opisowej. Wydawnictwo: Vizja Press & IT, Warszawa
2008.
3. A. Aczel, Statystyka w zarządzaniu : pełny wykład (przekł.: Zbigniew Czerwiński, Wojciech Latusek).
Wydawnictwo Naukowe PWN, Warszawa 2006.
4. M. Sobczyk, Statystyka. Wydawnictwo Naukowe PWN, Warszawa

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	48	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	52	2,00