COURSE DESCRIPTION CARD - SYLLABUS

Course name
Probability and statistics

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish language

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes

Other (e.g. online)

Tutorials
8

Projects/seminars

Number of credit points

4

Lecturers

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

Prerequisites

A student has the basic general knowledge of mathematics from the course Mathematical analysis. The student is able to use differential and integral calculus. The student is aware of the level of their knowledge and the need of deepening and expansion of their knowledge.

Course objective

The main aim of this course is to familiarize the student with: the basic concepts of probability theory, descriptive statistics, and mathematical statistics; the methods of determining the parameters of random variables and the applications of selected distributions of random variables to describe the random phenomena; the data presentation methods and the methods of determining the statistical measures; the selected methods of statistical inference.

Course-related learning outcomes

Knowledge

1. The student has the basic general knowledge of mathematics including the selected sections of probability theory, descriptive statistics, and mathematical statistics.
2. The student has the knowledge of applications of the selected distributions of random variables to the modeling of random phenomena.
3. The student has the knowledge of statistical data presentation methods.

Skills

1. The student is able to: determine the probabilities of random events, determine the parameters of random variables, determine the statistical measures, investigate the correlation between two sets of observations, determine the estimators of unknown population parameters, and test the statistical hypotheses concerning the expected value and the variance.
2. The student is able to find the information in a literature.

Social competences

1. The student is able to critically assess their knowledge.
2. The student understands the need for further education.
3. The student is able to think and act creatively.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

The knowledge acquired during the lecture is verified on the basis of a written test. To pass the lecture it is necessary to get at least 50% of the points from the mentioned written test.

Tutorials:

The skills acquired during the classes are verified on the basis of a colloquium. To pass the classes it is necessary to get at least 50% of the points from the mentioned colloquium.

Grading system:

- 0%-50% - 2.0,
- 50%-60% - 3.0,
- 60%-70% - 3.5,
- 70%-80% - 4.0,
- 80%-90% - 4.5,
- 90%-100% - 5.0.

Programme content

Lecture:

1. Probability theory:

- elements of combinatorics (a permutation, a variation with repetition, a variation without repetition, a combination),
- random events and a probability (a space of elementary events, a general definition of probability, a

classical definition of probability, a conditional probability, an independence of random events),
- random variables and their distributions (a random variable, a distribution of the random variable, a cumulative distribution function of the random variable, the review of selected discrete type distributions, the review of selected continuous type distributions, an independent random variables),
- an expected value (an expected value of a simple random variable, an expected value for a function of the random variable),
- parameters of random variables (quantiles of the random variable, moments of the random variable, a variance of the random variable, a covariance of random variables, a correlation coefficient of random variables),
- the central limit theorem (the Lindeberg-Levy theorem).
2. Descriptive statistics:
- basic concepts of statistics,
- data presentation methods (a frequency distribution),
- statistical measures (measures of central tendency, measures of variability, measures of asymmetry, measures of concentration),
- measures of correlation between two sets of observations (the Pearson correlation coefficient, the Spearman rank correlation coefficient).
3. Mathematical statistics:
- a concept of estimation (a point estimation, an interval estimation),
- statistical hypothesis testing (parametric significance tests).

Tutorials:
1. Probability theory (random variables of discrete and continuous type - the distribution of a random variable, the cumulative distribution function of a random variable, applications of: a binomial distribution, the Poisson distribution, a geometric distribution, a continuous uniform distribution, an exponential distribution, and a normal distribution).
2. Descriptive statistics (frequency distributions and statistical measures - an arithmetic mean, a mode, a median, quartiles, a range, an interquartile range, a quartile deviation, typical areas of variation, a mean absolute deviation from the mean, a variance, a standard deviation, coefficients of variation, a mode skewness, the Pearson mode coefficient of skewness, a quartile skewness, the Bowley quartile coefficient of skewness, the Pearson moment coefficient of skewness, a kurtosis, an excess kurtosis, the Lorenz curve, the Gini coefficient).
3. Mathematical statistics (interval estimation and parametric significance tests - confidence intervals for the unknown mean value, confidence intervals for the unknown variance or the unknown standard deviation, significance tests for the mean value, significance tests for the variance).

Teaching methods

Lecture: traditional lecture (theory presented in connection with the current knowledge of students).

Tutorials: blackboard tutorials (solving of math problems with the help of a teacher).

Bibliography

Basic

1. A. Plucińska, E. Pluciński, Probabilistyka: statystyka matematyczna, procesy stochastyczne, rachunek prawdopodobieństwa, Wydawnictwo Naukowe PWN SA, Warszawa, 2017.
2. W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach 1: Rachunek prawdopodobieństwa, Wydawnictwo Naukowe PWN, Warszawa, 2012.
3. W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach 2: Statystyka matematyczna, Wydawnictwo Naukowe PWN, Warszawa, 2012.

Additional

1. W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław, 2010.
2. H. Jasiulewicz, W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław, 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	104	4,0
Classes requiring direct contact with the teacher	26	1,0
Student's own work (literature studies, preparation for tutorials, preparation for the colloquium, preparation for the written test)[1]	78	3,0

[1] delete or add other activities as appropriate