



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Statistical methods in scientific research

### Course

Field of study

Engineering management

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Katarzyna Filipiak

Responsible for the course/lecturer:

Institute of Mathematics

ul. Piotrowo 3A, 60-965 Poznań

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### Prerequisites

Basic knowledge in mathematical analysis, algebra of sets and descriptive statistics

### Course objective

The aim of this course is to give the opportunity to learn and discuss basic problems of probability theory and methods of statistical inference. Presented material should give the opportunity to solve selected engineering problems.

### Course-related learning outcomes

Knowledge

1. The student has extended and in-depth knowledge of statistical modelling and its applications to processes appearing in organizations



2. The student has extended and in-depth knowledge of collecting statistical data and of the behavior of market participants

#### Skills

1. The student can apply theoretical knowledge about statistical modelling to describe and analyze social processes and phenomena
2. The student can express opinions, can collect the data properly and analyze the data
3. The student can formulate problems and use statistical measures and estimators for statistical analysis of social phenomena; can interpret the results and write conclusions
4. The student can formulate statistical hypotheses and interpret the results
5. The student can model and prognose the behavior of complex social processes, can describe the relations between social phenomena

#### Social competences

1. Understanding of interdisciplinary of knowledge and abilities of identification and solving basic problems related to the direction of the studies; understanding of necessity of creating interdisciplinary teams
2. Ability of formulating questions precisely in order to deepen his own understanding of a given subject or ability to recognize missing elements of reasoning
3. Understanding of the importance of professional behave, obeying the rules of ethics and respecting for diversity of views and cultures

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- Practical course (tutorials) - test comprising probability theory and mathematical statistics; the student has to collect at least 50% of possible points; the test is scheduled for the last class in the semester
- Lecture - theoretical test based on the material presented during the lectures; the student has to collect at least 50% of possible points; the test is scheduled for the last lecture in the semester

#### Programme content

Lecture:

1. Discrete random variable: notation and definitions, discrete distributions, binomial distribution
2. Continuous random variable: notation and definitions, continuous distributions, exponential distribution, normal distribution
3. Inference about populations: statistics and their distributions, t-Student distribution, chi-square distribution



4. Statistical inference: point and interval estimation of population mean, variance and proportion
5. Statistical inference: testing hypotheses about population mean, variance and proportion
6. Analysis of variance
7. Correlation and regression

Tutorials:

1. Basic concepts of probability: definition of probability and its properties, independence, conditional probability, total probability, Bayes' theorem
2. Discrete random variable: notation and definitions, discrete distributions, binomial distribution  
2. Continuous random variable: notation and definitions, continuous distributions, exponential distribution, normal distribution
3. Continuous random variable: notation and definitions, continuous distributions, exponential distribution, normal distribution
4. Inference about populations: statistics and their distributions, t-Student distribution, chi-square distribution
5. Statistical inference: point and interval estimation of population mean, variance and proportion
6. Statistical inference: testing hypotheses about population mean, variance and proportion
7. Analysis of variance

**Teaching methods**

Lectures (multimedia presentations) - presenting the theory connected with a current students' knowledge, presenting a new topic preceded by a reminder of related content known to students from other subjects

Practical course (tutorials) - solving examples on the blackboard, discussions in groups, applications of statistical methods to solve real problems in groups and individually

**Bibliography**

Basic

1. Kryszicki, W., J. Bartos, W. Dyczka, K. Królikowska and M. Wasilewski: Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, wydanie 8. PWN Warszawa, 2012
2. Bobrowski, D. and K. Maćkowiak-Łybacka: Wybrane metody wnioskowania statystycznego. Wyd. PP, Poznań, 2004



Additional

1. Devore, J.L.: Probability and Statistics for Engineering and Sciences, Brooks/Cole, 2012
2. Ross, S.M.: Introductory Statistics, Elsevier, 2010

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for tutorials, preparation for tests/final test from theoretical knowledge) <sup>1</sup>	45	1,5

<sup>1</sup> delete or add other activities as appropriate