COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematical Statistics [S1MwT1>SM]

Course

Field of study
Mathematics in Technology

Year/Semester
3/5

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
15

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

probability theory, differential and integrals calculus for the functions of one and more variables, matrix algebra, R software (basic skills)

Course objective

The aim of this course is to give the opportunity to learn and discuss basic problems of mathematical statistics, including selected problems of probability theory as well as the properties of statistics and statistical methods used for the experimental data inference. Presented material should give the opportunity to solve selected engineering problems.

Course-related learning outcomes

Knowledge:
1. The student has knowledge about methods of proving theorems and determining the properties of statistical variables, as well as the techniques of statistical inference
2. The student has knowledge about basic theorems used in probability theory and mathematical statistics
3. The student is able to write algorithms for solving the problems of mathematical statistics

4. The student knows how to collect observations and how to analyze the data

Skills:
1. The student can apply basic probability distributions and theorems to build up statistical models and to show the properties of statistics and can describe methodology of statistical inference
2. The student can formulate engineering problems and use statistical measures and estimators for statistical analysis of experiments, with the use of analytical methods as well as computer tools; can interpret the results and write conclusions
3. The student can collect and analyze data
4. The student can work individually as well as in a team, can estimate the time for solving the problem; can describe and realize the schedule of the work

Social competences:
1. Understanding of the own knowledge limits and motivation for further education
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 the social role played by the graduate of technical university, ability of identification and solving basic problems related to the direction of the studies

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
- Practical course (tutorials) - test
- Laboratory course - test / project
- Lecture - theoretical and practical exam based on the lecture material

Programme content

Lectures:
1. Selected problems of probability theory: functions of random variables and random vectors, selected probability distributions and continuous distributions and their transformations, distributions of quadratic forms, Jansen"s inequality
2. Statistics and the families of probability distributions: statistical model, sample moments and statistics based on the central tendency measures, probability distributions of selected statistics, sufficient statistics and factorization theorem, Minimal sufficient statistics, information matrix, ancillary and complete statistics
3. Estimation theory: estimation methods, point estimation, confidence interval estimation, estimators series and consistent estimators
4. Theory of hypotheses testing: basic definitions, most powerful tests and Neyman-Pearson lemma, likelihood ratio tests, most powerful tests for models with monotone likelihood ratio property and Karlin-Rubin theorem
5. Statistical inference for large samples: maximum likelihood estimators, confidence intervals, hypotheses testing

Tutorials:
1. Selected problems of probability theory: functions of random variables and random vectors, selected probability distributions and continuous distributions and their transformations, distributions of quadratic forms, Jansen inequality
2. Statistics and the families of probability distributions: statistical model, sample moments and statistics based on the central tendency measures, probability distributions of selected statistics, sufficient statistics and factorization theorem, Minimal sufficient statistics, information matrix, ancillary and complete statistics
3. Estimation theory: estimation methods, point estimation, confidence interval estimation, estimators series and consistent estimators

Laboratory classes:
1. Verification of the empirical distributions of statistics by simulation studies with the use of R package
2. Studies on the properties of point estimates of unknown parameters by simulations with the use of R package
3. Construction of statistical tests and studies on their properties by simulations with the use of R packacge

Teaching methods

Lectures - 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
Laboratory classes - group programming, simulations

Bibliography

Basic
1. Krzyśko, M. (2004). Statystyka Matematyczna. Wydawnictwo Naukowe UAM w Poznaniu
Additional
1. Mukhopadhyay, N. (2000). Probability and Statistical Inference. Marcel Dekker, Inc., New Yor k

Breakdown of average student's workload

	Hours	ECTS
Total workload	130	5,00
Classes requiring direct contact with the teacher	63	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	67	2,50