COURSE DESCRIPTION CARD - SYLLABUS

Course name

Theory of Experiments

Course

Field of study

Mathematics in Technology

Year/Semester

1/1

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

30

Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

probability theory, mathematical statistics, multivariate statistics, matrix algebra, matrix derivatives

Course objective

The aim of this course is to give the opportunity to learn and discuss basic problems of the theory of experiments, including linear models and planning of experiments as well as the theory devoted to regression models. Presented material should give the opportunity to solve selected engineering problems.

Course-related learning outcomes

Knowledge

1. The student has knowledge about basic theorems used in theory of experiments, including planning of experiments and statistical inference under linear and regression models

2. The student has knowledge about methods of proving theorems and determining the properties of variables that appears in theory of experiments as well as the techniques of statistical inference

Skills

1. The student can apply basic theorem to determine the properties of estimators, to plan experiments 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.

3. 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:

Practical course (tutorials) - two tests

Lecture - theoretical and practical exam based on the lecture material

Programme content

Lectures:

1. Linear model: identifiability and estimability, ordinary least squares estimators, best linear unbiased estimators, maximum likelihood estimators, minimum variance unbiased estimators, estimators distributions, generalized least squares estimators, normal equations, Bayes estimation

2. Models of experimental designs: completely randomized designs, completely randomized block designs, variance balanced desings, effective desings, optimality criteria, block designs with repeated measurements

3. Mixed models: fixed and random effects, estimation of variance components, testing hypotheses about variance components

4. Regression analysis: regression coefficients, correlation coefficient, testing hypotheses about significance of regression coefficients, prediction

5. Generalizations: planning experiments in models with additional nuisance parameters, planning and analysis of experiments with interaction, planning and analysis of multivariate experiments

Tutorials:

1. Linear model: identifiability and estimability, ordinary least squares estimators, best linear unbiased estimators, maximum likelihood estimators, minimum variance unbiased estimators, estimators distributions, generalized least squares estimators, normal equations, Bayes estimation

2. Models of experimental designs: completely randomized designs, completely randomized block designs, variance balanced desings, effective desings, optimality criteria, block designs with repeated measurements

3. Mixed models: fixed and random effects, estimation of variance components, testing hypotheses about variance components

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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

Bibliography

Basic

1. Krzyśko, M. (2004). Statystyka Matematyczna. Wydawnictwo Naukowe UAM w Poznaniu

2. Rao, C.R. (1982). Modele liniowe statystyki matematycznej. PWN Warszawa

Additional

1. Christensen, R. (2002). Plane Answers to Complex Questions: The Theory of Linear Models. Springer, New York.

2. Dean, A.M., Voss, D. (1999). Design and Analysis of Experiments. Springer.

3. Dey, A. (1981). Theory of Block Design. Wiley.

4. Hinkelman, K., Kempthorne, O. (1994). Design and Analysis of Experiments. Introduction to Experimental Design. Wiley.

5. Pukelsheim, F. (1993). Optimal Design of Experiments. Wiley, New York.

6. Raghavarao, D., Padgett, L.V. (2005). Block Designs. Analysis, Combinatorics and Applications. World Scientific Publishing

7. Shah K.R., Sinha B.K. (1989). Theory of Optimal Designs. Springer, New York

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam) [1]	25	1,0

[1] delete or add other activities as appropriate