UNIVERSITY OF BORÅS

Applied Statistical Design of Experiments

Tillämpad statistisk försöksplanering

7.5 credits
7.5 högskolepoäng

Ladok Code: FRRST03
Version: 4.1
Established by: The Research education committee in Resource Recovery 2021-02-16
Valid from: Spring 2021

Education Cycle: Third cycle
Research Subject: Resource Recovery
Prerequisites: The student has to be admitted to a PhD-programme. The Examiner can make exceptions from this rule.
Grading Scale: Fail (U) or Pass (G)

Content

- Principles of factorial experiments, linear models, balanced experiments and analysis of variance.

-General linear models, effects and contrasts
-Qualitative and quantitative factors
-ANOVA
-Blocking and randomization
-Fixed and random factors

- Properties and uses of basic models and experimental plans

-Factorial experiments
-Randomized block experiments
-Latin squares, Graeco-Latin squares and incomplete block experiments
-Factorial experiments with two levels, reduced factorial experiments, blocking and confounding of effects
-Hierarchical and split-plot experiments
-Taguchidesigns
-Linear and quadratic models
-Center points and linearity checking
-Response surface methods
Analysis and choice of experimental plan, sample sizes and replicates.
Calculation (estimation) of model parameters and analysis of variance for identification of significant effects.
Model validation techniques
-Normal plots
-Residual structure

- Analysis using statistical package SPSS, MiniTab or general calculation programs Matlab, Excel.

Learning Outcomes

This course aims to give PhD students the tools necessary to apply statistical design of experiments in a research situation. Statistical design of experiments is a wide subject that treats a large number of methods for planning experimental investigations in a manner that ensures statistically valid conclusions. Efficient use of these methods requires, in addition to knowledge of the standard models, a good understanding of theoretical and practical deviations between model and reality. The student needs to learn about basic factorial models and practice these in simple examples and with computer tools. The methods must also be applied to larger real world research problems where model assumptions and question about model validity are addressed.

Forms of Teaching

The course will have a series of lectures presenting the standard models and their properties, discuss basic underlying principles and methods for analyzing experimental results. This complemented with tutorials in how to use statistical software and analysis of the statistical methodology in existing research reports. The students work to develop and formulate experimental plans related to their individual research projects. The results from the individual work is presented and discussed in seminars.

The teaching language is partly, or fully, English

Forms of Examination

If the student has received a decision/recommendation regarding special pedagogical support from the University of Borås due to disability or special needs, the examiner has the right to make accommodations when it comes to examination. The examiner must, based on the objectives of the course syllabus, determine whether the examination can be adapted in accordance with the decision/recommendation.

Student rights and obligations at examination are in accordance with guidelines and rules for
the University of Borås.

Literature and Other Teaching Methods

Cochran, Cox: Experimental Designs

Klaus Hinkelman, Oscar Kempthorne: Design and Analysis of Experiments: Introduction to Experimental Design (Wiley Series in Probability and Statistics) (Hardcover)

Box, Hunter, Hunter: Statistics For Experimenters

Montgomery: Design and analysis of Experiments

NIST Engineering Statistics Handbook

http://www.itl.nist.gov/div898/handbook/toolaids/pff/index.htm

Student Influence and Evaluation

The head of department and teacher responsible for the course are responsible for ensuring that students are invited systematically and regularly to put forward their views on the course. The results of the evaluations will be reported back to the students and will form the basis for the future structure of the course.

Miscellaneous

The tentative schedule is 14 course sessions of 3 hours divided as follows:
Lectures: 7-8 lectures of 2x45 minutes.
Case studies and computer tutorials 1 or 2x 45 minutes per session
Seminars with presentations and analysis of research reports and students research related experimental plans.