

Experimental design

Course code:	PNS0049
Application code:	SLU-P0011
Application deadline:	2019-09-11
Cycle:	No specific cycle
Subject:	Statistics, Computer Science and Systems Science
Credits:	4 credits
Location:	Umeå
Study pace:	20
Study time:	Daytime
Distance:	Mandatory lectures and workshops as well as distance work
Language:	English

Subjects

Statistics, Computer Science and Systems Science, Experimental design, Response surface methodology

Education cycle

Third cycle

Module

Single module

Grading scale

Passed/failed

Language

English

Entry requirements

MSc or PhD students in forestry, engineering, chemistry, biology.

Scope

Lectures and exercises (5 * 8 h), home and group work

Learning outcomes

After the course, the students will be able to;

- Identify the basic principles of experimental design
- Use the software program MODDE for experimental design
- Recognise and use different design types
- Determine a suitable regression model based on design data
- Identify and apply different tools for model diagnostics

Purpose

To provide a practical course on the use of experimental design and response surface methodology for modelling empirical data. It covers relevant background and theory required to select and analyse an appropriate experimental design for extracting information about a system. An ideal starting point for every experimenter who wishes to work effectively, extract maximal information and predict the future behaviour of their system.

Content

Screening designs, optimization designs, mixture designs, regression modeling, predictions, analysis of variance.

Pedagogical form

Lectures on the theories behind multilinear regression modelling. Examples and exercises in the statistical software MODDE are used to introduce practical aspects and problems often encountered while using experimental design. One simple group task is performed where students set up an experimental design, perform empirical work and evaluate data with MLR. In addition, individual guidance on experimental design for a research study is given.

This is largely a self-study course and the students are encouraged to bring their own experimental planning tasks and to apply experimental design methodology to these during the course. The lecture/exercise/discussion sessions are concentrated in blocks and between the blocks reading and calculation assignments are given. Experienced guest lecturers will present relevant cases from their research.

Material: Presentation slides, course reader, datasets

Background literature:

Box GEP, Hunter ST, Hunter WG, Statistics of Experiments (2nd ed.), John Wiley & Sons, Inc., Hoboken, New Jersey, 2005.

Eriksson, L, Johansson, E, Kettaneh-Wold, N, Wikström, C, Wold, S, Design of experiments – Principles and applications, Umetrics AB, Umeå, 2008. ISBN 91-973730-4-4.

Myers RH, Montgomery DC, Anderson-Cook CM, Response Surface Methodology, Process and Product Optimization Using Designed Experiments (3rd ed.), John Wiley & Sons, Inc., Hoboken, New Jersey, 2009.

Time table

	Whole days (8:30-16:00)
Day 1 (16/9)	Background, Factorial design
Day 2 (18/9)	Factorial design, Diagnostics, Optimization
Day 3 (20/9)	Central composite designs, mixture design, blocking, qualitative variables
Day 4 (12/11)	Experimental work – group task
Day 5 (13/11)	Analysis and evaluation of group task and time for individual project guidance

Pass grade requirements

Lecture and workshop attendance, approved group task, and approved examination task

Responsible department

Forest Biomaterials and Technology

Teachers: Mikko Mäkelä, mikko.makela@aalto.fi (affiliated to SLU), Sylvia Larsson, sylvia.larsson@slu.se, and guest lecturers

Course leader

Sylvia Larsson

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