

# Experimental Design and Biostatistics

Programme course

6 credits

Försöksplanering och biostatistik

TAMS38

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Chemistry, Biology  
and Biotechnology

**Date determined**

2017-01-25

## Main field of study

Mathematics, Applied Mathematics

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Chemical Biology, M Sc in Engineering
- Engineering Biology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Mathematics, Master's programme

## Specific information

This course cannot be included in the same degree as the courses TAMS75, TAMS33 or TAMS12 .

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

A first course in probability and statistics

## Intended learning outcomes

The course is intended to give an introduction to the design and analysis of factorial experiments. The emphasis is on design of experiments, selection of model, analysis of observed data, ability to interpret the results and to draw conclusions. Knowledge of alternative nonparametric methods is also essential. By the end of the course, the student should be able to:

- design factorial experiments of different types using appropriate randomization;
- choose a suitable model to describe observed data taking into account the design of the experiment that generated the data, then perform an appropriate analysis and draw conclusions by means of hypothesis testing and construction of confidence intervals;
- make multiple comparisons of parameters with a given simultaneous confidence level;
- check model adequacy and need of transformation of data;
- design, conduct and analyse complete and reduced  $2^k$  factorial experiments;
- use nonparametric methods to analyse data of different types and discuss the applicability of the methods;
- use generalized linear models to analyse data, interpret the analyses and discuss the adequacy of the methods;
- use power calculations to determine the sample size for certain kinds of random experiments;
- use statistical software (e.g., Minitab or Matlab) to analyse data from factorial experiments for both parametric and nonparametric methods.

## Course content

Single-factor (including random effects model), two-factor and multifactor experiments in theory and practice. Randomized blocks, Latin squares and related designs. Complete  $2^k$  factorial designs and fractional factorial designs. Construction of factorial designs. Response surface methods. Analysis of variance. Pairwise and multiple comparisons. Guidelines for designing experiments. Transformation of data. Power calculations. Nonparametric methods; sign test, Wilcoxon's tests, Kruskal-Wallis test, Friedmann's test. General linear models. Generalized linear models. Analysis of data by using statistical software.

## Teaching and working methods

Teaching consists of lectures, lessons, obligatory computer lessons and obligatory assignments.

## Examination

UPG1	Hand in excersises	1 credits	U, G
LAB1	Computer exercises	1 credits	U, G
TEN1	Written examination	4 credits	U, 3, 4, 5

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Matematiska institutionen

## Director of Studies or equivalent

Ingegerd Skoglund

## Examiner

Zhenxia Liu

## Course website and other links

<http://courses.mai.liu.se/GU/TAMS38>

## Education components

Preliminary scheduled hours: 56 h

Recommended self-study hours: 104 h

## Course literature

### Additional literature

#### Books

Montgomery, D.C., *Design and analysis of experiments*. 7th/8th edition

#### Compendia

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).