

**MSA650, LINEAR MIXED MODELS FOR LONGITUDINAL DATA,  
7.5 credit points**

*Level: advanced*

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**1. Authorisation.**

The course plan has been authorised by the vice-dean of the Department of Mathematical Sciences on November 09, 2006, to be valid from the same date.

*Educational field:* Mathematical Sciences

**2. Educational context.**

The course is part of the Master Program in Mathematical Sciences. It is also open for students outside the program who meet the course prerequisites.

**3. Prerequisites.**

Students are expected to be familiar with basic statistical inference and to have taken some course in regression and analysis of variance, like MSG500 Linear statistical models.

**4. Learning outcomes.**

The student shall understand the mixed model framework and be able to recognize common study designs and models with longitudinal data or otherwise correlated observations. The student shall be able to conduct an appropriate statistical analysis of models covered in the course using standard software.

**5. Course description.**

This course is an introduction to the area of mixed models which has become a necessary tool for treating real life situations with e.g. random effects, correlated observations and missing data. The emphasis is on longitudinal data and on how to use SAS and R to analyse mixed models. The coursework includes moment involving the following topics: Exploratory Data Analysis, Estimation of the Marginal Model, Inference for the Marginal Model, Inference for the Random Effects, Fitting Linear Mixed Models with SAS, General Guidelines for Model Building, Exploring Serial Correlation, Local Influence for the Linear Mixed Model, The Heterogeneity Model, Conditional Linear Mixed Models, Exploring Incomplete Data, Joint Modeling of Measurements and Missingness, Simple Missing Data Methods, Selection

Models, Pattern-Mixture Models, Sensitivity Analysis for Selection Models, Sensitivity Analysis for Models, How Ignorable is Missing at Random?, The Expectation-Maximization Algorithm, Design Considerations, Case Studies

**6. Literature.**

Linear Mixed Models for Longitudinal Data Series: Springer Series in Statistics by Verbeke, Geert, Molenberghs, Geert and handouts.

**7. Assessment.**

Home assignments and written final examination

**8. Grades.**

The grade levels are Fail (U), Pass (G), and High Pass (VG). A wish for an ECTS grade should be reported to the examiner at the beginning of the course.

**9. Course evaluation.**

In the middle of the course the teacher arranges an oral feedback discussion with the students. At the end of the course the students are asked to answer an internet based questionnaire. The results of the questionnaire will be processed by the lecturer together with student representatives.

**10. Additional information.**