GÖTEBORG UNIVERSITY **COURSE PLAN MSF200**
Faculty of Sciences
Mathematical Sciences

MSF200, STOCHASTIC PROCESSES, 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 9, 2006, to be valid from July 1, 2007.

Educational field: Mathematical Sciences

2. Educational context.
The course is part of the Master Program in Mathematical Sciences and is also open for students outside the program who meet the course prerequisites. In addition, the course is intended to be suitable for graduate students in applied mathematical sciences as well as from other fields in science.

3. Prerequisites.
An undergraduate course in mathematical statistics. In addition, it is very useful for students that do not have a theoretical, mathematical or mathematical statistical focus in their studies to have taken one of the courses MSG800 Basic Stochastic Processes, MSG860 Basic Stochastic Processes F, or Random Processes with Applications, or some other additional course in mathematical statistics.

4. Goals and learning outcomes.
Calculus, including integration, differentiation and differential equations are of fundamental importance for modelling in most branches on natural sciences. However, these tools are insufficient to model a large number of phenomena which include "chance" or "uncertainty". Examples of such phenomena are noise disturbances of signals in engineering, uncertainty about future stock prices in finance, and the macroscopic result of many microscopic random particle movements in natural sciences. Among the most important tools required for the modelling of the latter phenomena are stochastic processes. The course gives a solid knowledge of stochastic processes, intended to be sufficient for applications in mathematical sciences as well as natural sciences, at all levels.

An advanced treatment of the theory of stochastic processes relies on probability theory and mathematical analysis. The purpose of the course is to give such a treatment. This means that there is a certain focus on proofs and rigour, instead of reasoning and learning by means of applications and examples. As well as being suitable for students with a more theoretical interest, the course is suitable for gaining deepened knowledge of stochastic processes for applied students with a background from one of the courses MSG800 Basic Stochastic Processes, MSG860 Basic Stochastic Processes F or Random Processes with Applications.

5. Course description.
What is a stochastic process? Distribution theory. Time series with random walks. Brownian motion and diffusions. Elements of Lévy processes. Gaussian processes. Stationarity and weak stationarity. Continuous time Markov chains. Elements of Queues. Self-similar processes. Elements of filtering and forecasting. Elements of simulation and numerical methods.

6. Literature.
To be determined.

7. Assessment.
Written final examination. Home assignement on applied and/or numerical aspects of stochastic processes.

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.
During the course the teachers arrange one or two get-togethers with the students, to get feedback on the results so far. At the end of the course the students will be asked to answer a questionnaire, the results of which will be processed by the teachers together with student representatives.

10. Additional information.
The course is given in English. A more basic treatment of stochastic processes, in part by means of applications and examples, is given in the courses MSG800 Basic Stochastic Processes and MSG860 Basic Stochastic Processes F. A treatment of stochastic processes with a special focus on signal processing in electrical engineering is given in Random Processes with Applications.