MASC04, Mathematical Statistics: Stationary Stochastic Processes, 7.5 credits
Matematisk statistik: Stationära stokastiska processer, 7,5 högskolepoäng
First Cycle / Grundnivå

Details of approval
The syllabus was approved by Study programmes board, Faculty of Science on 2007-06-14 to be valid from 2007-07-01, autumn semester 2007.

General Information
The course is an elective course for first-cycle studies for a Bachelor of Science in Mathematics/Master of Science in Mathematical Statistics.

Language of instruction: Swedish and English

Main field of studies Depth of study relative to the degree requirements
Mathematics G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes
The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding
On completion of the course, the students are expected to:
• be able to perform calculations using expectations, variance, covariance, and cross-covariance within and between different stationary processes,
• be able to calculate the relationship between covariance properties in the timedomain and spectral properties in the frequency domain for one and several processes,
• be able to formulate linear filters using covariance and spectral properties,
• be able to estimate covariance function, spectrum, and other parameters in stationary processes using data.
Skills and abilities
On completion of the course, the students are expected to:

- be able to identify natural situations where a stationary process is a suitable mathematical model, e.g., within at least one engineering, science, or economics application,
- be able to formulate a stationary stochastic process model using a concrete problem within the chosen application,
- be able to suggest model parameters, with the help of data,
- be able to interpret the model and translate model concepts to a conclusion regarding the original problem.

Judgement and approach
On completion of the course, the students are expected to:

- be able to read and interpret technical literature with elements of stationary processes within the chosen application,
- be able to describe the model structure and the conclusions,
- be able to describe the possibilities and limitations of stochastic models.

Course design
- Models for stochastic dependence.
- Concepts of description of stationary stochastic processes in the time domain: expectation, covariance, and cross-covariance functions.
- Concepts of description of stationary stochastic processes in the frequency domain: effect spectrum, cross spectrum.
- Special processes: Gaussian process, Wiener process, white noise, Gaussian fields in time and space.
- Stochastic processes in linear filters: relationships between in- and out-signals, auto regression and moving average (AR, MA, ARMA), derivation and integration of stochastic processes.
- The basics in statistical signal processing: estimation of expectations, covariance function, and spectrum.
- Application of linear filters: frequency analysis and optimal filters.

Course implementation
Teaching consists of lectures, exercises and computer exercises. Participation in computer exercises is compulsory.

Assessment
The examination consists of a written exam. Students who fail the regular exam are offered a re-examination shortly afterwards.

Subcourses
0701 Exam, 7.5 hp Grading scale: Fail, Pass, Pass with distinction
0702 Computer Exercises, 0.0 hp Grading scale: Fail, Pass

**Grades**

For a passing grade on the entire course a passing grade on the written exam, passed computer exercise reports and participation in compulsory parts are required. The final grade is the grade on the written exam.

Marking scale: Fail, Pass, Pass with distinction.

**Entry requirements**

For admission to the course knowledge equivalent to the courses MASA01, Mathematical Statistics: Basic Course, 15 credits and MASC01, Mathematical Statistics: Probability Theory, 7.5 credits is required.