Faculty of Science

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 and was last revised on 2007-06-14. The revised syllabus applies 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

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 time domain 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.

Competence and skills

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 content

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 design

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 that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
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.

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.

Subcourses in MASC04, Mathematical Statistics: Stationary Stochastic Processes

Applies from H15

0703 Laboratory Work part 1, 0,5 hp
Grading scale: Fail, Pass
0704 Laboratory Work part 1, 1,0 hp
Grading scale: Fail, Pass
0705 Exam, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction

Applies from V08

0701 Exam, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction
0702 Computer Exercises, 0,0 hp
Grading scale: Fail, Pass