Stochastic Processes

Programme course

6 credits

Stokastiska processer

TAMS32

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical
Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics, Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Mathematics, Master's Programme
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering

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
Basic courses in probability and statistics. Linear algebra and multivariate analysis. Transform theory is helpful, but not required.

Intended learning outcomes

In broad terms, the course treats statistical models and methods for randomly varying quantities which are also functions of time. These are fundamental for the advanced study of telecommunications theory, signal theory, control theory, robotics, and many important phenomena in biology, physics, computer networks, and economy. After a completed course the student is expected to be able to:

- describe the basic concepts and theorems in the theory of stochastic processes, e.g., expectation and autocovariance function and spectral density.
- describe important classes of stochastic processes, e.g., the Wiener process, martingales, wide sense stationary processes, and Markov chains, and their special properties.
- make use of stochastic processes to construct relevant models for randomly varying quantities which are functions of time.
- carry out important computations for stochastic processes, such as linear time invariant filtration, and prediction of the values of a process at unobserved times.
- understand and assess models based on stochastic processes and analyses of such models occurring in other undergraduate courses, or the media.

Course content

Multivariate distributions, in
particular the multivariate normal distribution. Conditioning and
conditional expectation. The moment generating function. Stochastic
processes: basic properties and examples. Expectation function,
autocovariance function, cross covariance function. The Poisson
process and the Wiener process. Martingales in discrete time.
Stationary and wide sense stationary processes. Gaussian processes. Mean square
convergence and the mean square integral. Linear time invariant filtering.
Spectral densities. ARMA processes. Prediction. Markov chains in
discrete and continuous time.

Teaching and working methods

Lectures and tutorials. Home assignments which are not mandatory but give bonus points at the written examination.

Examination

TEN1	Written Examination	6 credits	U, 3, 4, 5

Grades

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

Other information

Supplementary courses: Probability theory, advanced course. Stochastic processes applied to finance. Control theory. Biomedical signal processing. Classification and decision support.

Department

Matematiska institutionen

Director of Studies or equivalent

Ingegerd Skoglund

Examiner

Torkel Erhardsson

Course website and other links

http://courses.mai.liu.se/GU/TAMS32

Education components

Preliminary scheduled hours: 48 h
Recommended self-study hours: 112 h

Course literature

Additional literature

Books

Roy D. Yates & David J.Goodman, (2005) *Probability and stochastic processes. A Friendly introduction for electrical and computer engineers* 2nd ed John Wiley

Other

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://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.