



**LUND**  
UNIVERSITY

Faculty of Science

## **MASM26, Mathematical Statistics: Stationary and non-stationary Spectral Analysis, 7.5 credits**

*Matematisk statistik: Stationär och icke stationär spektralanalys,  
7,5 högskolepoäng*  
Second Cycle / Avancerad nivå

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### **Details of approval**

The syllabus was approved by Study programmes board, Faculty of Science on 2007-01-31 and was last revised on 2007-01-31. The revised syllabus applies from 2007-07-01, autumn semester 2007.

### **General Information**

The course is an elective course for second-cycle studies for a Master of Science in Mathematical statistics.

*Language of instruction:* Swedish and English

*Main field of studies*

Mathematical Statistics

Mathematics

*Depth of study relative to the degree requirements*

A1F, Second cycle, has second-cycle course/s as entry requirements

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### **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:

- interpret and understand parametric and non-parametric spectral estimation methods.
- interpret and understand spatial spectral analysis and classical estimation techniques of directions.

- interpret and understand time-frequency analysis and classical estimation techniques of non-stationary spectra.

### **Competence and skills**

On completion of the course, the students are expected to:

- be able to estimate classical parametric and non-parametric spectral estimates.
- be able to estimate spectra of non-uniformly sampled sequences.
- be able to use classical time-frequency methods for estimation.

### **Course content**

Basic definitions. Extended studies of AR (auto regressive), MA (moving average) and ARMA-processes. Line-spectra and parametric estimation methods. Noise-space based techniques. Non-parametric spectral estimators, data-adaptive techniques and multi-taper methods. Non-uniform sampling. Orientation of circular and non-circular processes. Spatial spectral analysis. Non-stationary processes. Spectrogram. Wigner-Ville distribution. Cohen class. Ambiguity spectrum. Multi-taper techniques for non-stationary signals. Orientation about bi-spectrum.

### **Course design**

Teaching consists of lectures, home assignments, exercises, computer exercises and projects. Participation in computer exercises and thereby integrated teaching is compulsory.

### **Assessment**

The examination is done written and orally by home assignments and computer exercise reports.

*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 passing grade on the entire course passed home assignments, computer exercise reports and participation in compulsory parts are required.

The grade is formed by weighing together the results on the parts which are included the examination.

### **Entry requirements**

For admission to the course knowledge equivalent to the courses MASC04, Stationary Stochastic processes, 7.5 credits and MASM17, Mathematical Statistics: Time series analysis, 7.5 credits are required together with English B.



## Subcourses in MASM26, Mathematical Statistics: Stationary and non-stationary Spectral Analysis

Applies from V16

- 0703 Laboratory Work, 3,0 hp  
Grading scale: Fail, Pass
- 0704 Assignment part 1, 1,0 hp  
Grading scale: Fail, Pass
- 0705 Assignment part 2, 3,5 hp  
Grading scale: Fail, Pass

Applies from V12

- 1101 Assignm. - Stationary and non-Stationary Spectral Analysis, 4,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 1102 Project - Stationary and non-Stationary Spectral Analysis, 3,5 hp  
Grading scale: Fail, Pass, Pass with distinction