

This is an introductory course to statistical estimation theory given from a signal processing perspective. The course covers fundamental concepts such as sufficient statistics, the Rao-Blackwell theorem and the Cramer-Rao lower bound on estimation accuracy. Furthermore, the most common estimation methods are treated, including maximum likelihood, least-squares, minimum variance and Bayesian estimation.

Further information about course syllabus and learning outcomes are given in the KTH course and programme directory at the following [link \(https://www.kth.se/student/kurser/kurs/EQ2810?l=en\)](https://www.kth.se/student/kurser/kurs/EQ2810?l=en).

## Registration

Remember to register yourself to the course by using KTH My Pages.

## Organization

- Lectures 6 or 7\*2 h
- Weekly homework assignments, 6 problem sets
- One mandatory project
- Exam if homework assignments are not properly solved

The course language is English.

## Literature

- "Fundamentals of Statistical Signal Processing: Estimation Theory," Kay, Steven M. ISBN 0133457117.

## Course responsible/Lecturer

[Magnus Jansson \(https://www.kth.se/profile/janssonm\)](https://www.kth.se/profile/janssonm)

## Teaching assistant

## Project assignment (mandatory)

Instructions are handed out during the course. The project will count towards the final grade.

## Homework assignments

A set of problems will be assigned every week and solutions should be submitted within one week. Course contents can be learnt by cooperative discussions, but homework problems should be solved individually and handed in in due time for grading. Please recall the KTH rules for examination.

Preliminary grading will be: E=60%, D=65%, C=70%, B=80%, A=90% of max score.

See link in the left menu to "Assignments" to download and submit homework.

## Preliminary Schedule

See KTH central schedule for the official times and lecture rooms. The Canvas calendar for this course should also be up to date. We have seven slots scheduled, Tuesdays 13.15-15.

Preliminary we will use six of them for normal lectures:

Lec. 1: Ch. 1-3 [lec1\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2111105/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2111105/download?wrap=1)   
(https://canvas.kth.se/courses/11302/files/2111105/download?wrap=1)

Lec. 2: Ch. 4-5 [lec2\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2134672/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2134672/download?wrap=1)   
(https://canvas.kth.se/courses/11302/files/2134672/download?wrap=1), [CRB.pdf](https://canvas.kth.se/courses/11302/files/2134675/download?wrap=1)  
(https://canvas.kth.se/courses/11302/files/2134675/download?wrap=1)   
(https://canvas.kth.se/courses/11302/files/2134675/download?wrap=1)

Lec. 3: Ch. 6-7 [lec3\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2156403/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2156403/download?wrap=1)   
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wrap=1)   
(https://canvas.kth.se/courses/11302/files/2157324/download?wrap=1)  
(https://canvas.kth.se/api/v1/canvadoc\_session?  
blob=%7B%22moderated\_grading\_whitelist%22:null,%22enable\_annotations%22:null,%22enrollment\_type%22:n  
ull,%22anonymous\_instructor\_annotations%22:null,%22submission\_id%22:null,%22user\_id%22:8779000000000  
4948,%22attachment\_id%22:2157324,%22type%22:%22canvadoc%22%7D&hmac=4ba7c487191bafa5c2ac18b32a  
6227f3d9b61143)

Lec. 4: Ch. 8-9 [lec4\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2174950/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2174950/download?wrap=1)   
(https://canvas.kth.se/courses/11302/files/2174950/download?wrap=1)

Lec. 5: Ch. 10-11 [lec5\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2194331/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2194331/download?wrap=1)   
(https://canvas.kth.se/courses/11302/files/2194331/download?wrap=1)

Lec. 6: Ch. 12,14,15, [lec6\\_handout.pdf](https://canvas.kth.se/courses/11302/files/2215299/download?wrap=1) (https://canvas.kth.se/courses/11302/files/2215299/download?wrap=1)  
 (https://canvas.kth.se/courses/11302/files/2215299/download?wrap=1)

Lec. 7: Reserve, project?

We may need to add some slots later for project presentations or the like.

## Outline of the book

- Ch. 1: Introduction
- Ch. 2: Minimum Variance Unbiased Estimation
- Ch. 3: Cramer Rao Lower Bound
- Ch. 4: Linear Models
- Ch. 5: General Minimum Variance Unbiased Estimation
- Ch. 6: Best Linear Unbiased Estimators
- Ch. 7: Maximum Likelihood Estimation
- Ch. 8: Least Squares
- Ch. 9: Method of Moments
- Ch. 10: The Bayesian Philosophy
- Ch. 11: General Bayesian Estimators
- Ch. 12: Linear Bayesian Estimators
- Ch. 14: Summary of Estimators
- Ch. 15: Extensions for Complex Data and Parameters

(Ch. 13: Kalman filtering - will not be covered in this course, see Adaptive signal processing or Optimal filtering courses)