

## Estimation and Decision Techniques (E003421)

Due to Covid 19, the education and assessment methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

**Course size** *(nominal values; actual values may depend on programme)*

**Credits** 4.0      **Study time** 120 h      **Contact hrs** 30.0h

### Course offerings in academic year 2021-2022

A (semester 1)	English	Gent
B (semester 1)	Dutch	Gent

### Lecturers in academic year 2021-2022

Luong, Hiep	TW07	lecturer-in-charge
Noels, Nele	TW07	co-lecturer

### Offered in the following programmes in 2021-2022

	crdts	offering
Bridging Programme Master of Science in Bioinformatics(main subject Engineering)	4	A
Bridging Programme Master of Science in Industrial Engineering and Operations Research	4	A
Bridging Programme Master of Science in Industrial Engineering and Operations Research	4	A
Master of Science in Electrical Engineering (main subject Communication and Information Technology )	4	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	4	A
Master of Science in Bioinformatics(main subject Engineering)	4	A
European Master of Science in Photonics	4	A
Master of Science in Computer Science Engineering	4	B
Master of Science in Computer Science Engineering	4	A
Master of Science in Industrial Engineering and Operations Research	4	B
Master of Science in Industrial Engineering and Operations Research	4	A
Master of Science in Photonics Engineering	4	A

### Teaching languages

English, Dutch

### Keywords

Estimation, Decision, Detection, Mean Square Error, Maximum Likelihood, Bayesian Inference

### Position of the course

This introductory course aims at providing insight into a number of alternative methods that can be applied to estimate unknown quantities (estimation) or in testing hypotheses (decision).

These methods are applied in a.o. communications engineering, signal processing, and data processing.

### Contents

- Introduction: problem formulation
- Classical estimation theory: Fisher estimation, minimum-variance unbiased estimates, maximum-likelihood estimates, Pearson's method of moments, linear estimates, least-squares estimates
- Bayesian estimation theory: Bayesian estimates, linear Bayesian estimates
- Decision theory: classical decision, Bayesian decision
- Conclusions: overview

### Initial competences

Know how to apply the basic rules of probability theory, possess knowledge about

frequently used probability distributions

### **Final competences**

- 1 Cast estimation or detection problems into a mathematical model.
- 2 Determine optimal receiver structures.
- 3 Determine (or approximate) the performance of receiver structures.
- 4 Develop an intuitive feeling for the resulting solution.
- 5 Weigh the pro's and con's of the different paradigms.

### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Guided self-study, Lecture, Seminar: coached exercises

### **Learning materials and price**

Syllabus (in English, available for download on the electronic learning environment or for sale at the price of the copies)

### **References**

- S. Kay, "Fundamentals of Statistical Signal Processing, Volume 1: Estimation Theory" (Prentice Hall, 1993).
- S. Kay, "Fundamentals of Statistical Signal Processing, Volume 2: Detection Theory" (Prentice Hall, 1998).

### **Course content-related study coaching**

Interactive support through the electronic learning environment and/or personal (by appointment)

### **Assessment moments**

end-of-term assessment

### **Examination methods in case of periodic assessment during the first examination period**

Written examination, Open book examination

### **Examination methods in case of periodic assessment during the second examination period**

Written examination, Open book examination

### **Examination methods in case of permanent assessment**

### **Possibilities of retake in case of permanent assessment**

not applicable

### **Extra information on the examination methods**

During examination period: written open-book exam - problems

### **Calculation of the examination mark**