

## Modulation and Detection (E012130)

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

**Credits** 6.0      **Study time** 180 h      **Contact hrs** 60.0 h

**Course offerings and teaching methods in academic year 2017-2018**

A (semester 1)	guided self-study	30.0 h
	seminar: coached exercises	20.0 h
	group work	10.0 h
B (semester 1)	lecture	30.0 h
	group work	10.0 h
	seminar: coached exercises	20.0 h

**Lecturers in academic year 2017-2018**

Moeneclaey, Marc	TW07	lecturer-in-charge
Jacobs, Lennert	TW07	co-lecturer

**Offered in the following programmes in 2017-2018**

	crdts	offering
<a href="#">Bridging Programme Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a>	6	B
<a href="#">Master of Science in Electrical Engineering (main subject Communication and Information Technology)</a>	6	B
<a href="#">Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a>	6	B
<a href="#">Master of Science in Computer Science Engineering</a>	6	B
<a href="#">Master of Science in Computer Science Engineering</a>	6	B
<a href="#">Master of Science in Electrical Engineering</a>	6	A

**Teaching languages**

Dutch, English

**Keywords**

modulation, detection, channel estimation, equalization

**Position of the course**

The course aims at providing insight in the operation and the performance of optimum and suboptimum receivers for digital communication over various types of channels. Topics are : detection, channel estimation, equalization, multi-user communication, modulation for dispersive channels.

**Contents**

- Decision and estimation theory: Likelihood function, decision and estimation according to ML and MAP criteria
- Channel models: Static channels, fading channels, coherence time, coherence bandwidth
- Detection of digital information: Time, frequency and spatial diversity; equalization (linear, decision-feedback, Viterbi)
- Multiuser communication: FDM(A), TDM(A), FDD, TDD Modulations suited for dispersive channels: Spread-spectrum and CDM(A), multiuser interference; OFDM, cyclic prefix
- Estimation of channel parameters

**Initial competences**

**Final competences**

- 1 To have insight in the operation of algorithms for detection, equalization and channel estimation.
- 2 To apply techniques for multiuser communication.
- 3 To apply modulation techniques for transmission over dispersive channels and to determine their performance.
- 4 To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link.

**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, group work, lecture, seminar: coached exercises

**Learning materials and price**

lecture notes (about 10 EUR)

**References**

- J.G. Proakis, Digital Communications. McGraw-Hill
- H. Meyr, M. Moeneclaey, S.A. Fechtel, Digital Communication Receivers - Synchronization, channel estimation, and signal processing. J. Wiley

**Course content-related study coaching**

The lecturer and assistants are available during contact hours, on appointment and via e-mail.

**Evaluation methods**

end-of-term evaluation and continuous assessment

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

Written examination, open book examination

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

Written examination, open book examination

**Examination methods in case of permanent evaluation**

Assignment

**Possibilities of retake in case of permanent evaluation**

examination during the second examination period is possible in modified form

**Extra information on the examination methods**

During examination period: written open-book exam. During semester: graded team work. Frequency: 1 report at end of semester.

**Calculation of the examination mark**

First examination period: non periodical (graded team work) 30%; periodical (exam) 70%. If both scores are not at least 8/20, the student cannot pass for the course. The end score is then the lowest of the two scores.

Second examination period: written exam counts for 70%, score from team work in first examination period counts for 30%. If the score from the team work in the first examination period is less than 8/20, the student will have to pass an additional (individual) oral examination on the team work. If the score of the written examination and, if applicable, of the additional oral examination is not at least 8/20, the student cannot pass for the course. The end score is then the lowest of the two scores.