

## Sensors and Interfacing (E640080)

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)	Dutch	group work	18.0 h
		lecture	24.0 h
		practicum	18.0 h

Lecturers in academic year 2017-2018

Willems, Brecht	TW06	staff member
Missinne, Jeroen	TW06	lecturer-in-charge

Offered in the following programmes in 2017-2018

	crdts	offering
<a href="#">Master of Science in Electronics and ICT Engineering Technology (main subject Electronics Engineering)</a>	6	A
<a href="#">Master of Science in Electronics and ICT Engineering Technology (main subject MIT)</a>	6	A

Teaching languages

Dutch

Keywords

Sensors, calibration, signal conditioning, linearisation, microcontroller, interfacing, sensor characteristics, accuracy.

Position of the course

The course gives the student an overview of the main sensors and sensor characteristics. Beside the operation, fabrication and applications, also the interfacing, linearity, calibration and accuracy are covered.

Contents

**Part Theory:**

- In the part regarding sensor characteristics, the main properties of sensors are discussed such as sensitivity, transfer function, resolution, accuracy, DC and AC properties
- Interfacing: in this part, the most commonly used electronics for reading out sensors is discussed: opamp circuits, instrumentation amplifier, bridge circuits, etc.
- Overview of sensors and sensor technologies, such as:
  - Temperature sensors
  - Mechanical sensors (force, pressure)
  - Light sensors, image sensors
  - Sensor technology: discussion of the fabrication of some important sensors
  - Biosensors
  - Straining gages + optical version (fiber Bragg grating sensor)
  - Position sensors, displacement sensors
  - Case study or guest lecture

**Part Lab:**

During the lab sessions students build an application with one or more sensors seen during the theoretical sessions. More complex projects are worked out in group.

Initial competences

Competences described in the courses:

- Embedded Systems
- Basic Electronics

## Final competences

- 1 KNOWLEDGE and UNDERSTANDING: Understanding and describing the operation of various sensor principles and knowledge of their application domain; Defining and declaring terms such as linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Performing and commenting on linearization, bridge operation and push-pull action; Recognizing and explaining basic circuits for reading out sensors, such as opamp circuits, instrumentation amplifiers and bridge operation.
- 2 SKILLS: use of datasheets; understanding and critically reading of scientific papers; Practical experience with a few sensors and corresponding readout electronics. Being able to apply scientific knowledge for solving complex engineering problems, particularly choosing the most suitable sensor for a specific application.
- 3 ATTITUDES: taking inaccuracies and measurement errors into account when designing, optimizing and executing measurements for a sensor application.

## 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

Group work, lecture, practicum

## Extra information on the teaching methods

Theory: Lectures  
Lab: practicum

## Learning materials and price

Course notes written by lecturer (in English)  
Extra papers and documentation on Minerva

## References

Book: Sensor Technology Handbook  
Jon S. Wilson  
Elsevier  
ISBN: 0-7506-7729-5

## Course content-related study coaching

Students can get extra explanation:  
- during the lab sessions  
- individual, after appointment  
- during the organized explanation sessions

## Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination

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

Written examination

## Examination methods in case of permanent evaluation

Oral examination, report

## 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

First examination period:  
PE1 - Theory: written examination  
NPE - Lab : Report lab results + oral exam about the practical knowledge and practical skills acquired during the labs  
Second examination period:  
PE2 - Theory: written examination  
NPE - Labo: rework of one exercise + oral exam about the practical knowledge and practical skills acquired during the labs

## Calculation of the examination mark

50% theory + 50% practicum  
In order to pass, one has to attain a score of at least 8/20 for both periodic and permanent evaluation. If this condition is not fulfilled, and when the

calculated score is 10/20 or more, the student may be failed by the examiner and gets a score of 9/20.  
If exam in the second examination period for the lab, then 80% of the result is transferred.