

Sensors and Interfacing (E735040)

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

Credits 6.0

Study time 180 h

Course offerings in academic year 2024-2025

A (semester 1)

Dutch

Gent

Lecturers in academic year 2024-2025

Willems, Brecht

TW06

staff member

Missinne, Jeroen

TW06

lecturer-in-charge

Offered in the following programmes in 2024-2025

Master of Science in Electronics and ICT Engineering Technology(main subject Electronics Engineering)

crdts

6

offering

A

Master of Science in Electronics and ICT Engineering Technology(main subject Embedded Systems)

6

A

Master of Science in Electronics and ICT Engineering Technology(main subject ICT)

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

This course unit builds on certain course competencies/learning outcomes of course units Embedded Systems: Microcontrollers, Electronics II, 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 unaccuracies 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, Practical

Extra information on the teaching methods

Theory: Lectures

Lab: practical course/project (in group). Presence during the labs on campus is compulsory.

For practical reasons, students should be enrolled for the course before the start of week 3.

In the case of exceptional hygienic conditions, modifications can be appended such as switching to a better matching teaching method.

Study material

Type: Syllabus

Name: Course notes Sensors and Interfacing

Indicative price: Free or paid by faculty

Optional: no

Language : English

Number of Pages : 110

Available on Ufora : No

Online Available : No

Available in the Library : No

Available through Student Association : No

Additional information: students will receive the printed course notes free of charge

Type: Slides

Name: Slides sensors and interfacing

Indicative price: Free or paid by faculty

Optional: no

Language : English

Number of Slides : 400

Available on Ufora : Yes

Online Available : Yes

Available in the Library : No

Available through Student Association : No

Type: Lab Material

Name: Arduino Uno

Indicative price: € 24

Optional: yes

Available through Student Association : No

Usability and Lifetime within the Course Unit : intensive

Usability and Lifetime within the Study Programme : regularly

Usability and Lifetime after the Study Programme : occasionally

References

Book: Sensor Technology Handbook

Jon S. Wilson

Elsevier

ISBN: 0-7506-7729-5

Course content-related study coaching

- Students can receive additional explanation:
- during or after the lectures and lab sessions
 - individually, after making an appointment

Assessment moments

end-of-term and continuous assessment

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

Written assessment

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

Written assessment

Examination methods in case of permanent assessment

Oral assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

First examination period:

PE1 - Theory: written examination, closed book.

NPE - Lab : Report lab results + oral exam about the practical knowledge and practical skills acquired during the labs, e.g. in the form of a presentation

Second examination period:

PE2 - Theory: written examination, closed book.

Calculation of the examination mark

50% theory + 50% lab

- 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 will be failed by the examiner and gets a score of 9/20.
- If a student has a theory exam in the second examination period, then the score obtained for the lab in the first examination period will be transferred.