

Sensors and Actuators (E008445)

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

Credits 6.0 Study time 180 h Contact hrs 45.0 h

Course offerings and teaching methods in academic year 2019-2020

A (semester 2)	English	lecture	15.0 h
		guided self-study	15.0 h
		practicum	15.0 h

Lecturers in academic year 2019-2020

De Smet, Herbert	TW06	lecturer-in-charge
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Offered in the following programmes in 2019-2020

	crdts	offering
Bridging Programme Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	A
Master of Science in Biomedical Engineering	6	A
International Master of Science in Biomedical Engineering	6	A
Master of Science in Biomedical Engineering	6	A

Teaching languages

Dutch, English

Keywords

sensor and actuator operating principles, datasheets, accuracy, noise, calibration, system analogies, signal conditioning, linearisation, bridge circuits, transimpedance amplifier, photodiode interfacing, MEMS sensors and actuators, instrumentation software, interfacing, data acquisition, analog and digital data transmission, shielding

Position of the course

This is an intermediate course about sensors and actuators that assumes a good initial knowledge of physics and electronics. It aims at giving the students a good understanding of the possibilities and limitations of the different sensor and actuator types and the different ways they can be interfaced. Furthermore it provides some hand-on experience of how to use them in practice.

Contents

- Introduction
- Primary sensors
- Sensor electronics and signal conditioning
- Sensor types
- Actuators

Initial competences

Having successfully completed "Physics I", "Physics II", "Electrical circuits and networks" and "Analog electronics" (or having acquired equivalent competences in another way).

Final competences

- 1 Thoroughly understand and discuss the operation of electromotive, resistive, capacitive, inductive and primary sensors and actuators.
- 2 Explain linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Explain and/or derive linearization, bridge circuits, differential operation, transimpedance amplifiers.
- 3 Using sensors and actuators efficiently in practical applications, including the

consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way.

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, practicum

Extra information on the teaching methods

Guided self-study = guided online exercises

Learning materials and price

- Syllabus: English; partly existing already (140 pages); extensions to be added. Sold via VTK.
- Viewfoils: English; free via the electronic learning platform
- Practicum: English; assignment and data provided free via online learning system or downloaded from the internet; hardware material available free of charge in EA06 student lab.

References

- 1 J. Fraden, "Handbook of Modern Sensors" (AIP)
- 2 R. Pallàs-Areny / John Webster, "Sensors and signal conditioning" (Wiley and Sons)
- 3 Ilene J. Busch-Vishniac, "Electromechanical Sensors and Actuators"
- 4 Georges Asch, "Les Capteurs en Instrumentation Industrielle"
- 5 John P. Bentley, "Principles of Measurement Systems"
- 6 P. Rai-Choudhury, "Handbook of Microlithography, Micromachining and Microfabrication, Volume 2"
- 7 Aldert Van Der Ziel, "Noise", Prentice-Hall
- 8 James J. Allen, "Micro Electro Mechanical System Design", Taylor & Francis (available on "EngNetBase")

Course content-related study coaching

Interactive support via online learning platform.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Oral examination

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

Oral examination

Examination methods in case of permanent evaluation

Skills test, 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

- During examination period: oral closed-book exam with written preparation.
- Permanent evaluation: graded lab sessions (practicum), graded exercises. Frequency: 3 lab sessions + 2 exercises.

Calculation of the examination mark

Special conditions: lab sessions + graded exercises: 33%. Examination: 67%