

# Course Specifications

From the academic year 2016-2017 up to and including the

## Sensors and Actuators (E008440)

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

Credits 4.0 Study time 120 h Contact hrs 37.5 h

Course offerings and teaching methods in academic year 2017-2018

|                |         |           |        |
|----------------|---------|-----------|--------|
| A (semester 2) | English | lecture   | 15.0 h |
|                |         | project   | 12.5 h |
|                |         | practicum | 10.0 h |

Lecturers in academic year 2017-2018

|                  |      |                    |
|------------------|------|--------------------|
| De Smet, Herbert | TW06 | lecturer-in-charge |
|------------------|------|--------------------|

Offered in the following programmes in 2017-2018

|  | crdts | offering |
|--|-------|----------|
| <a href="#">Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a> | 4     | A        |
| <a href="#">Master of Science in Biomedical Engineering</a>  | 4     | A        |
| <a href="#">International Master of Science in Biomedical Engineering</a>                                  | 4     | A        |
| <a href="#">Master of Science in Biomedical Engineering</a>  | 4     | A        |
| <a href="#">Master of Science in Computer Science Engineering</a>  | 4     | A        |
| <a href="#">Master of Science in Computer Science Engineering</a>  | 4     | A        |

Teaching languages

Dutch, English

Keywords

sensor operation principles, accuracy, calibration, linearisation, datasheet, bridge, noise, shielding, system analogies, instrumentation software, LabView, interfacing, data transport

Position of the course

This is a basic course about sensors and actuators, that assumes a basic knowledge of electronics.

It aims at teaching the students to take in to account the possibilities and limitations of the different sensor types and to gain some hands-on experience in interfacing them.

Contents

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

Initial competences

Having successfully completed "Analogue Electronics" or "Electrical Networks" (+ a good external knowledge of operational amplifiers) or "Electronic Systems and Instrumentation"; or having acquired the equivalent competences in another way.

Final competences

- 1 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 ('push-pull') operation
- 3 Using sensors and actuators in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware

(PC-) 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

Lecture, practicum, project

#### Learning materials and price

Syllabus: English. +/- 130 pages, sold by Student organisation VTK.

Viewfoils: English - free via Minerva website

#### 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 via "EngNetBase")

#### Course content-related study coaching

Interactive via Minerva (forums, e-mail)

#### 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, written preparation

During semester: graded project reports; graded lab sessions. Second chance:

Possible in adapted form

Frequency: 2 lab exercises and 1 project

#### Calculation of the examination mark

Evaluation throughout semester as well as during examination period. Special conditions: Exam 2/3 and (lab exercises + project) 1/3