Sensors and Microsystem Electronics (E030940)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course Specifications
Valid as from the academic year 2021-2022

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>60.0 h</td>
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</tbody>
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Course offerings and teaching methods in academic year 2021-2022

A (semester 2)
- English
- Gent
- practicum: 15.0 h
- project: 16.25 h
- group work: 1.25 h
- lecture: 27.5 h

B (semester 2)
- Dutch
- Gent
- guided self-study: 27.5 h
- group work: 1.25 h
- practicum: 15.0 h
- project: 16.25 h

O (semester 2)
- English
- Gent

Lecturers in academic year 2021-2022
- De Smet, Herbert
  - TW06
  - lecturer-in-charge
- Vasquez Quintero, Andrés Felipe
  - TW06
  - co-lecturer

Offered in the following programmes in 2021-2022

- Bridging Programme Master of Science in Photonics Engineering: 6 A
- Master of Science in Electrical Engineering (main subject Communication and Information Technology): 6 A
- Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation): 6 A
- Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering): 6 A
- Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems): 6 A
- Master of Science in Electromechanical Engineering (main subject Maritime Engineering): 6 A
- Master of Science in Electromechanical Engineering (main subject Mechanical Construction): 6 A
- Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering): 6 A
- European Master of Science in Photonics: 6 A
- Master of Science in Photonics Engineering: 6 B
- Master of Science in Photonics Engineering: 6 A, O

Teaching languages
- Dutch, English

Keywords

(Approved)
Position of the course
This compulsory course in the Photonics curriculum teaches the student the necessary skills for the electronic and opto-electronic interfacing of microsystems, including the use of sensors and actuators. This comprises transistor circuits, opamp circuits as well as microcontroller-based solutions, with hands-on experience.

Contents
- Sensors and actuators: Types of sensors and actuators, Calibration, signal conditioning and linearity
- Electronic interfacing of sensors and actuators: Transistor circuits, Microcontroller concepts, interfacing with PCs using IO cards, Matrix addressing and readout (microdisplays, imaging sensors)
- Electronic transmission of data: Analog transmission, Digital transmission, (eliminating) interferences
- Microsystems, practice examples: Systems using basic components, Integrated Circuit systems (e.g. RFID tag, PON receiver chip), Systems based on existing modules/components, Systems exhibiting strong opto-electronic interaction (microdisplays, CCD/CMOS imaging chips, power-LEDs)

Initial competences
Good basic knowledge of analog electronics and device physics.

Final competences
1. Understand and describe the operation of electromotive, resistive, capacitive, inductive and primary sensors and actuators
2. Define and explain notions such as linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Derive and comment on linearisation, bridge operation and 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
4. Deal with solid-state lights sources in an energy efficient way and take into account etendue limitations and electronic driving efficiency
5. Recognizing and explaining basic electronic circuits useful for sensor interfacing
6. Explain and discuss the operation and construction of the microsystems that were treated during the case studies.

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, practicum, project

Extra information on the teaching methods
On campus lectures if can be organised in a safe manner; online lectures are a fall-back solution.
Because of COVID19 there is a chance that alternative work and teaching methods will have be deployed, especially concerning the labs and projects.

Learning materials and price
- syllabus (English; about 285 pages; sold through student organisation VTK; price in the range €8-€15.
- viewfoils (English; distributed for free via the electronic learning platform)

References

(Approved)
Course content-related study coaching
   Interactive support via the electronic learning platform (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 (with written preparation if organised on site; without written preparation if has to be organised online). During semester: graded project reports; graded lab sessions; graded homework. Frequency: 3 lab exercises + 2 projects + 1 homework.

Calculation of the examination mark
   Special conditions: lab exercises + projects + homework: 1/3%. examination: 2/3%.