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.

Lecturers in academic year 2020-2021
De Smet, Herbert TW06 lecturer-in-charge
Vasquez Quintero, Andrés Felipe TW06 co-lecturer

Offered in the following programmes in 2020-2021

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<th>Programme</th>
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<td>Bridging Programme European Master of Science in Photonics</td>
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<td>Master of Science in Electrical Engineering (main subject Communication</td>
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<td>and Information Technology )</td>
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<td>Master of Science in Electromechanical Engineering (main subject Control</td>
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<td>Engineering and Automation)</td>
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<td>Circuits and Systems)</td>
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<td>Master of Science in Electromechanical Engineering (main subject Maritime</td>
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<td>Engineering)</td>
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<td>Master of Science in Photonics Engineering</td>
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Teaching languages
Dutch, English

Keywords
sensors, actuators, calibration, signal conditioning, linearisation, microcontroller, interfacing, digital & analog transmission, LCOS microdisplay, PON receiver, LEDs

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 alinearisation

• 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, online lecture

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 225 pages, sold through student organisation VTK)
• viewfoils (English; distributed for free via the electronic learning platform)

References

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%.