GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2016-2017

Sensors and Microsystem Electronics (E030940)

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

Credits 6.0	Study time 180 h	Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2017-2018

A (semester 2)	English	lecture	27.5 h
		group work	1.25 h
		practicum	15.0 h
		project	16.25 h
B (semester 2)	Dutch	group work	1.25 h
		practicum	15.0 h
		project	16.25 h
		guided self-study	27.5 h

Lecturers in academic year 2017-2018

De Smet, Herbert	TW06	lecturer-in-charge

Offered in the following programmes in 2017-2018	crdts	offering
Bridging Programme European Master of Science in Photonics	6	A
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

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-elecronic 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

Learning materials and price

- syllabus (English, about 225 pages, sold through student organisation VTK)
- viewfoils (English; distributed for free via Minerva)

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] D.V. Bugg, "Circuits, Amplifiers and Gates", Adam Hilger
- [9] James J. Allen, "Micro Electro Mechanical System Design", Taylor & Francis (Available via "EngNetBase")

Course content-related study coaching

Interactive support 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; 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%.