GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2021-2022

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 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 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		guided self-study	27.5 h
			group work	1.25 h
			practicum	15.0 h
			project	16.25 h
0 (semester 2)	English			

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	**crdts**	**offering**
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, 0

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

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

- [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 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%.