GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2017-2018

Physics of Semiconductor Devices (E024641)

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)	Dutch	practicum	5.0 h
		guided self-study	40.0 h
		seminar: coached exercises	15.0 h
B (semester 2)	English	guided self-study	10.0 h
		seminar: coached exercises	15.0 h
		lecture	30.0 h
		practicum	5.0 h

Lecturers in academic year 2017-2018

Bakeroot, Benoit	TW06	lecturer-in-charge
Bauwens, Pieter	TW06	co-lecturer

Offered in the following programmes in 2017-2018	crdts	offering
Bridging Programme Master of Science in Engineering Physics	6	B
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	B
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	B
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	B
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	B
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	B
Master of Science in Photonics Engineering	6	B
Master of Science in Engineering Physics	6	B
Master of Science in Engineering Physics	6	A

Teaching languages

Dutch, English

Keywords

semiconductor devices, diode, heterostructures, metal-oxide-semiconductor (MOS) structures, MOS field effect transistor (MOSFET), bipolar transistor, solar cells

Position of the course

Detailed study of the physics of basic semiconductor devices (thermal equilibrium, DC, AC, and large signal characteristics, limitations, non-idealities). Overview of the technology of semiconductor devices. Study of some special devices (working principles, characteristics, use). Acquiring enough background knowledge as a tool for future self-study of other devices.

Contents

- Additions to semiconductor physics
- Advanced study of p-n junction diodes including heterojunctions
- The metal-semiconductor structure

- The metal-insulator-semiconductor structure
- Overview of the technology of semiconductor devices
- Metal-oxide-semiconductor field-effect transistors (MOSFETs)
- Bipolar transistors including heterostructures
- Charge coupled devices
- Semiconductor memories
- Solar cells
- A special component: thorough self-study of a semiconductor device

Initial competences

This course builds on certain learning outcomes of "Solid-State Physics and Semiconductors I and II" and of "Electrical Circuits and Networks".

Final competences

1 Thorough insight in the working principles of the building blocks (diodes, metal-semiconductor, and metal-insulator-semiconductor structures) of semiconductor devices: equilibrium, DC, AC, and large signal behavior.
2 Insight in the operation (equilibrium, DC, AC, and large signal) of the basic semiconductor devices: the MOSFET and the bipolar transistor including modern structures.
3 Recognise the most important process steps used in semiconductor device technology.
4 Analysing semiconductor devices: drawing band diagrams, assessing IV, CV characteristics, and switching behavior, comparing competing semiconductor devices.
5 Critical assessment of articles from scientific literature discussing semiconductor devices.

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, lecture, practicum, seminar: coached exercises

Learning materials and price

Lecture notes (English) and handouts powerpoint presentations (on Minerva)

References

- R. PIERRET, Semiconductor device fundamentals, Addison-Wesley Publ. Comp., Reading, Mass., USA, 1996
- S.M. SZE and Kwok K. Ng, Physics of semiconductor devices, 3rd. ed., Wiley & Sons, 2007
- S.M. Sze and M.K. Lee, Semiconductor Devices - Physics and Technology, 3rd. ed., Wiley & Sons, 2013.
- M. S. TYAGI, Introduction to semiconductor materials and devices, Wiley & Sons, 1991 (bib. ELIS: FD91)

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Open book examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Open book examination, oral examination

Examination methods in case of permanent evaluation

Open book examination, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

During examination period: theory: oral closed-book exam, written preparation; Exercises: written open-book exam; literature project: oral exam with open project

report.
Continuous assessment: evaluation of lab work and project report (literature assignment). Frequency: starting from week 6.

Calculation of the examination mark

The final mark is determined based on the following weighting coefficients: theory + exercises = 2/3; lab work + literature task = 1/3.
The mark on the lab work is transferred to the second-term, the mark on the literature can be transferred, or the literature task can be redone depending on the choice of the student.