GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Solid-state Physics and Semiconductors II (E024620)

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

Credits 3.0 **Study time 90 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	seminar
			practical
			lecture

Lecturers in academic year 2024-2025

Detavernier, Christophe	WE04	lecturer-in-charge
Minjauw, Matthias	WE04	co-lecturer

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Science in Engineering(main subject Engineering Physics)	3	A

Teaching languages

Dutch

Keywords

Surfaces, crystal defects, nanostructures, semiconductor junctions, superconductivity, crystal growth

Position of the course

To get acquainted with the physics of real crystals and crystals with small dimensions. To provide insight into processes and mechanisms governing the operation of semiconductor devices. To get acquainted with the phenomena and the theory of superconductivity.

Contents

- P-n junctions: Homojunctions, Heterojunctions
- Metal-semiconductor contacts and the MIS diode: Schottky barrier, Ohmic contact, MIS-diode and MOS
- Superconduction: Overview of experimental phenomena, Theoretical overview, Junctions of superconductors, High-Tc superconductors
- Surfaces and interfaces: Crystallography of surfaces, Surface states
- Crystal defects: Point defects, Dislocations and stacking faults
- Nanostructures: Quantum well, Quantum wires, Quantum dots
- Crystal growth: Growth techniques

Initial competences

Solid-state physices and semiconductors I

Final competences

1 Understanding the effect of electric fields and concentration gradients on the band structure in semiconductors.
2 Being able to draw and interpret energy band diagrams.
3 Using concepts from semiconductor physics to explain the operation of electronic components (p-n junction, heterojunction, metal/semiconductor contact, MOS structure).
4 Possess the practical skills for performing electrical measurements on semiconductor components.
5 Understanding the relationship between size and electronic properties of nanostructures and possess the scientific curiosity to explore them further.
6 Knowing key concepts related to superconductivity (e.g. Meissner effect, Cooper

pair, Josephson junction) and possess the scientific curiosity to explore them further.

7 Knowing key concepts related to defects in solids (vacancies, interstitials, color center, dislocations, stacking fault, surface, work function).

8 Knowing key concepts related to crystal growth and epitaxial growth.

9 Have the skills for solving exercises related to concepts in solid-state physics.

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

Seminar, Lecture, Practical

Study material

Type: Syllabus

Name: Vastestoffysica en halfgeleiders II
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 152
Oldest Usable Edition : 2022
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No
Additional information: -

References

- C. Kittel, "Introduction to Solid State Physics", 7th edition, J. Wiley, New York 1996

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

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

Oral assessment, Written assessment

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

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Skills test

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

- During examination period: theory exam is oral, with written preparation, closed-book; exercises as a written exam, open-book (lecture notes, no solutions to problems presented during the lectures) - problems.
- During semester: graded lab sessions. Frequency: 1 lab session half-way semester.

Calculation of the examination mark

Special conditions: 1 lab session, for 10% of the total result. The result of the lab work is transfered to the second exam period.