GHENT UNIVERSITY

Course Specifications

From the academic year 2017-2018 up to and including the

Solid State and Nano Physics (C001213)

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

Credits	6.0	Study time	180 h
Contact hrs	52.5 h		

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	integration seminar	5.0 h
		lecture	47.5 h

Lecturers in academic year 2018-2019

Detavernier, Christophe	WE04	lecturer-in-charge
Vrielinck, Henk	WE04	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Physics and Astronomy	6	A

Teaching languages

Dutch

Keywords

Solid state physics, optics, transport, nano physics

Position of the course

The content from the bachelor course on basic solid state physics is extented to solid state nano structures. A second objective of this course is to make students familiar with present-day research in this domain.

Contents

Theory of bulk semiconductors :
· Band structure
· Band-to-band transitions, optical absorption
· Effective mass theory, excitons, donors and acceptors
· Luminescence
· Classical transport (drift and diffusion)
· Depletion layers
· Applications
Solid state nano structures
· Energy levels and density of states in 0-2 dimensions
· Optical properties
· 2D systems : quantum wells, heterostructures
· 1D systems : nanowires, carbon nanotubes
· 0D systems : quantum dots
· Landauer formalism for conduction - ballistic transport
· Tunneling, Coulomb blockade
· Quantization of electrical conductance - quantum point contacts
Seminars
Current topics in solid state science : synthesis and characterization techniques, applications

Initial competences

Succeeded in the following bachelor courses (or their equivalent) : "Vastestoffysica", "Kwantummechanica" and "Atoom- en molecuulfysica".

Final competences

1 Using the band model to explain the operation of electronic and opto-electronic devices.
2 Calculating transition probabilities for optical transitions.
3 Calculating transport properties of low dimensional structures.

4 Understanding the influence of low dimensionality on the band structure of materials.
5 Knowledge of and critical attitude against current research topics 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

Lecture, integration seminar

Learning materials and price

Lecture notes: € 10

References

M. Fox, "Optical properties of solids", Oxford University Press, 2001
P. K. Basu, "Theory of optical processes in semiconductors", Oxford University Press, 1997
David Ferry, "Transport in Nanostructures", Cambridge University Press, 2000
T. Heinzel, "Mesoscopic electronics in Solid State Nanostructures", Wiley-VCH, 2007

Course content-related study coaching

E-learning on Minerva, possibility for contacting the lecturers by appointment.

Evaluation methods

end-of-term evaluation

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

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Oral exam with written preparation

Calculation of the examination mark

100% periodic evaluation