GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2015-2016

Quantum Mechanics I (E023010)

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 2016-2017

A (semester 2)	lecture	30.0 h
	lecture: plenary exercises	30.0 h

Lecturers in academic year 2016-2017

Van Neck, Dimitri	WE05	lecturer-in-charge
Ghysels, An	TW17	co-lecturer

Offered in the following programmes in 2016-2017	crdts	offering
Bachelor of Science in Engineering Physics	6	A
Bridging Programme Master of Science in Engineering Physics	6	A
Master of Science in Materials Engineering	6	A
Preparatory Course European Master of Science in Nuclear Fusion and Engineering Physics	6	A
Preparatory Course Master of Science in Engineering Physics	6	A

Teaching languages

Dutch

Keywords

Theory of Relativity, Quantum Physics

Position of the course

This course can be considered as an introduction to the traditional "Modern Physics" course. A short treatment of Einstein's special theory of relativity is given. Special attention goes to the experimental basis of Quantum Physics, emphasizing the limits of the classical physics and the introduction of Quantum Mechanics. The postulates are introduced among wich the time dependent Schrödinger Equation. In this lecture, applications are restricted one dimensional problems. More formal mathematical aspects of quantum theory are discussed as an introduction to the follow-up course "Quantum Mechanics II".

Contents

- Introduction to relativity theory: Light in moving frames of reference, The Lorentz transform, Relativistic dynamics, Applications
- Experimental basis of quantum mechanics: Photons, The photo-electric effect, Compton effect, Electron diffraction - De Broglie waves, Bohr's atom model, Wave-particle duality
- Wave function and wave packet - The Uncertainty Relation: Heisenberg's gamma ray microscope, two-slot experiment, free particle
- The Schrodinger equation: Schrodinger equation for free particle, Schrodinger equation for particle in external potential, One-dimensional applications
- The state space: Operators in quantum mechanics
- Postulates: Formulation of postulates, Heisenberg's Uncertainty Relation, Quantum Dynamics, Description in various images
- One-dimensional linear harmonic oscillator: eigen values and eigen states

Initial competences

Physics I and II

Final competences

1 Explaining quantisation of observables and the postulates of quantum mechanics.
2 Explaining and elucidating wave-particle duality.
3 Describing and applying the operator concept in quantum mechanics.
4 Having developed a scientific curiosity for quantum mechanics and its applications.

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, lecture: plenary exercises

Extra information on the teaching methods

Classroom lectures; Classroom problem solving sessions

Learning materials and price

Course notes available

References

- B.H. Bransden and G.J. Joachain: Introduction to Quantum Mechanics - Longman 1989.
- F.S. Levin: An Introduction to Quantum Theory - Cambridge Univ. Press 2002.

Course content-related study coaching

Evaluation methods

end-of-term evaluation

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

Written examination

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

Written examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

During examination period: written closed-book exam

Calculation of the examination mark

Evaluation during examination period