Technology
Arts Sciences
TH Köln

Course Manual QM

Quantum mechanics

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− General information

Long name	Quantum mechanics
Approving CModule	QM_MaET
Responsible	Prof. Dr. Uwe Oberheide Professor Fakultät IME
Valid from	winter semester 2020/21
Level	Master
Semester in the year	winter semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Uwe Oberheide Professor Fakultät IME
Requirements	In-depth knowledge of mathematics (integral calculus, differential calculus, vector geometry) Basic knowledge of physics (oscillations and waves, double slit, interference, thermodynamics, potential / kinetic energy) Basic knowledge of electrical engineering (magnetic and electric fields, components)

Literature

Harris – Moderne Physik, Pearson Verlag

Feynman - Vorlesungen über Physik Band III:Quantenmechanik, Oldenbourg Verlag

Final exam

Details	Testing the taxonomy levels of understanding and applying by describing the elementary quantum mechanical processes and their differentiation from the classical physical representation. Testing the taxonomy level analyzing on the basis of real applications and tracing back the quantum mechanical processes involved
Minimum standard	50 % of the questions correctly answered
Exam Type	EN mündliche Prüfung, strukturierte Befragung

Language	German
Separate final exam	Yes

Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	The failure of classical physics (black spot, photoelectric effect, Compton effect, Stern-Gerlach experiment, Bohr's atom model, matter waves) Quantum behaviour (experiments with spheres, waves and electrons; basic principles of quantum mechanics; principle of indeterminacy; laws of combination of amplitudes; identical particles) Schrödinger equation (development of the wave equation; stationary, time-dependent) simple potential problems (infinitely deep potential pot, finitely deep potential pot, potential stage, potential barrier, harmonic oscillator, hydrogen atom) Basic principles of quantum computers and quantum cryptography
Skills	Description of given physical problems mathematically by listing the Schrödinger equation and applying of methods to solve the differential equations (separation approaches, limit value considerations) To evaluate physical solutions and select them by analogy Analyzing quantum effects and transferring them to technical applications

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	3
Tutorial (voluntary)	0

Special requirements

none

Accompanying material	Presentation slides for the lecture Links to Internet resources with basic information
Separate exam	No

Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Discourse on quantum mechanical processes (uncertainty principle, wave-particle dualism, wave functions/packages) and their applications in real systems in the context of the course

Special requirements

none

Accompanying material	undefined
Separate exam	No

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Seminar	1
Tutorial (voluntary)	0