Quantum Mechanics

Title	Quantum Mechanics
Semester	F2023
Master programme in	Fysik / Mathematical Physical Modelling / Physics and Scientific Modelling
Type of activity	Course
Teaching language	English
Study regulation	Read about the Master Programme and find the Study Regulations at ruc.dk Læs mere om uddannelsen og find din studieordning på ruc.dk

REGISTRATION AND STUDY ADMINISTRATIVE

Registration	Sign up for study activities at stads selvbetjening within the announced registration period, as you can see on the Studyadministration homepage. When signing up for study activities, please be aware of potential conflicts between study activities or exam dates. The planning of activities at Roskilde University is based on the recommended study programs which do not overlap. However, if you choose optional courses and/or study plans that goes beyond the recommended study programs, an overlap of lectures or exam dates may occur depending on which courses you choose.
Number of participants	
ECTS	10
Responsible for the activity	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)
Head of study	Studieleder for Fysik (fys-sl@ruc.dk)
Teachers	
Study administration	INM Registration & Exams (inm-exams@ruc.dk)
Exam code(s)	U60047

ACADEMIC CONTENT

Overall objective	The course is offered for a short period of time and only to students who have passed the Bachelor Course in Problem Solving I. Quantum mechanics is treated as a self-consistent theoretical foundation in physics. Emphasis is placed on the student's acquisition of an in-depth understanding of, and practice in, problem solving within quantum mechanics, as well as an insight into different interpretations of quantum mechanics.
Detailed description of content	Quantum mechanics may be the most profound revolution in our understanding of the physical world and is in addition forming the basis for the development of technological milestones such as the laser and the semiconductor. The course aims at giving students a working knowledge of the quantum mechanical formalism which may appear strange and very abstract, but leads to quantitative predictions of e.g. the optical emission spectrum of atomic hydrogen. The introduction to the course is a historic and philosophical overview, while the main part of the course introduces the Schrödinger equation and solve the equation for different simple (model) cases. The quantum mechanical formalism is developed and finally the Schrödinger equation is solved for a real case: the hydrogen atom. The main emphasis in the course is on an intrinsic understanding of the formalism and application of the formalism to solve simple quantum mechanical problems.
Course material and Reading list	The course follows a text book, fx Introduction to Quantum Mechanics by David J. Griffiths and Darrell F. Schroeter. (Details will be specified on Moodle). Additional material is uploaded to Moodle.
Overall plan and expected work effort	The course will be planned as a mixture of lectures and solving of problems (pen and paper) including discussions of problems. In addition the students will work with solving quantum mechanical problems numerically. Quantum Mechanics 10 ECTS = 270h. Contact hours: 36+36+12=84 h ● Lectures 36 h ● Preparation for lectures 72 h ● Problem solving 36 h (in class) ● Preparation for problem solving 72 h ● Mini projects 12+12=24 h (12 in class, 12 independent work) ● Preparation for exam 26 h ● Exam 4h
Format	
Evaluation and feedback	The course includes formative evaluation based on dialogue between the students and the teacher(s). Students are expected to provide constructive critique, feedback and viewpoints during the course if it is needed for the course to have better quality. Every other year at the end of the course, there will also be an

	evaluation through a questionnaire in SurveyXact. The Study Board will handle all evaluations along with any comments from the course responsible teacher. Furthermore, students can, in accordance with RUCs 'feel free to state your views' strategy through their representatives at the study board, send evaluations, comments or insights form the course to the study board during or after the course.
Programme	The course will be planned as a mixture of lectures and solving of problems (analytically and numerically) including discussions of problems. Class by Class program will be posted on Moodle during the course.

ASSESSMENT

Overall learning outcomes	After completing the course the students will be able to • in-depth knowledge and understanding of quantum mechanics, seen as a self-consistent theoretical foundation in physics • knowledge and understanding of different interpretations of quan-tum mechanics • proficiency in solving problems and tasks relevant in quan-tum mechanics • proficiency in applying a variety of frequently used mathemati-cal methods in quantum mechanics • competences in assessing the relevance of applying quantum mechan-ics to a given physical research question • competences in determining which method(s) can be applied in solv-ing a given research question in quantum mechanics.
Form of examination	Individual written invigilated exam The duration of the exam is 5 hours. Permitted support and preparation materials for the exam: A formulae collection of max. one A4 size page (both sides of the paper may be used) made by the student. Assessment: 7-point grading scale. Moderation: Internal co-assessor.
Form of Re-examination	Samme som ordinær eksamen / same form as ordinary exam
Type of examination in special cases	
Examination and assessment criteria	The exam consist of a set of problems. The assessment is based on the student's skill to • in-depth knowledge and understanding of quantum mechanics, seen as a self-consistent theoretical foundation in physics

- proficiency in solving problems and tasks relevant in quan-tum mechanics
- proficiency in applying a variety of frequently used mathemati-cal methods in quantum mechanics

Exam code(s) Exam code(s) : U60047

Course days:

Hold: 1

Quantum Mechanics (PSM)

time 03-02-2023 08:15 til
03-02-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 06-02-2023 12:15 til
06-02-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics - study groups (PSM)

time 08-02-2023 10:15 til
08-02-2023 12:00

location 27.1-052 - lokale 2 (20)

Quantum Mechanics (PSM)

time 09-02-2023 10:15 til
09-02-2023 12:00

forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
Teacher	Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	10-02-2023 08:15 til 10-02-2023 10:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	13-02-2023 12:15 til 13-02-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics - study groups (PSM)

time	15-02-2023 10:15 til 15-02-2023 12:00
location	27.1-052 - lokale 2 (20)

Quantum Mechanics (PSM)

time	16-02-2023 10:15 til 16-02-2023 12:00
location	27.1-052 - lokale 2 (20)
Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time	17-02-2023 08:15 til 17-02-2023 10:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 20-02-2023 12:15 til
20-02-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics - study groups (PSM)

time 22-02-2023 10:15 til
22-02-2023 12:00

location 27.1-052 - lokale 2 (20)

Quantum Mechanics (PSM)

time 23-02-2023 10:15 til
23-02-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 24-02-2023 08:15 til
24-02-2023 10:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 27-02-2023 12:15 til
27-02-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics - study groups (PSM)

time 01-03-2023 10:15 til
01-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Quantum Mechanics (PSM)

time 02-03-2023 10:15 til
02-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 03-03-2023 08:15 til
03-03-2023 10:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 06-03-2023 12:15 til
06-03-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 09-03-2023 10:15 til
09-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 13-03-2023 12:15 til
13-03-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 16-03-2023 10:15 til
16-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 20-03-2023 12:15 til
20-03-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 23-03-2023 10:15 til
23-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 27-03-2023 12:15 til
27-03-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 30-03-2023 10:15 til
30-03-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Dorthe Posselt (dorthe@ruc.dk)
Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time 03-04-2023 12:15 til
03-04-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 13-04-2023 10:15 til
13-04-2023 12:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time 17-04-2023 12:15 til
17-04-2023 16:00

location 27.1-052 - lokale 2 (20)

Teacher Trond Ingebrigtsen (trond@ruc.dk)
Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	20-04-2023 10:15 til 20-04-2023 12:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	24-04-2023 12:15 til 24-04-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	27-04-2023 10:15 til 27-04-2023 12:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	01-05-2023 14:15 til 01-05-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time	04-05-2023 10:15 til 04-05-2023 12:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	08-05-2023 14:15 til 08-05-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time	11-05-2023 10:15 til 11-05-2023 12:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics (PSM)

time	15-05-2023 14:15 til 15-05-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics (PSM)

time	22-05-2023 14:15 til 22-05-2023 16:00
location	27.1-052 - lokale 2 (20)
Teacher	Trond Ingebrigtsen (trond@ruc.dk) Dorthe Posselt (dorthe@ruc.dk)

Quantum Mechanics - Question Hour (PSM)

time	30-05-2023 13:00 til 30-05-2023 15:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	27.1-052 - lokale 2 (20)

Teacher	Dorthe Posselt (dorthe@ruc.dk) Trond Ingebrigtsen (trond@ruc.dk)

Quantum Mechanics - Exam (PSM)

time	09-06-2023 10:00 til 09-06-2023 15:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	07.1-008 - undervisningslokale (60)

Quantum Mechanics - Reexam (PSM)

time	10-08-2023 10:00 til 10-08-2023 15:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	07.1-033 - undervisningslokale (30)