

TCM303 Quantum Mechanics IIb (2020-2023)

HUOM! OPINTOJAKSOJEN TIETOJEN TÄYTTÄMISTÄ KOORDINOIVAT KOULUTUSSUUNNITTELIJAT HANNA-MARI PEURALA JA TIINA HASARI

- 1. Course title
- 2. Course code
- 3. Course status: optional
- 4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)
- 5. Recommended time/stage of studies for completion
- 6. Term/teaching period when the course will be offered
- 7. Scope of the course in credits
- 8. Teacher coordinating the course
- 9. Course learning outcomes
- 10. Course completion methods
- 11. Prerequisites
- 12. Recommended optional studies
- 13. Course content
- 14. Recommended and required literature
- 15. Activities and teaching methods in support of learning
- 16. Assessment practices and criteria, grading scale
- 17. Teaching language

1. Course title

Kvanttimekaniikka IIb
Kvantmekanik IIb
Quantum Mechanics IIb

2. Course code

TCM303

Aikaisemmat leikkaavat opintojaksot 537172 Kvanttimekaniikka IIb, 5 op.

3. Course status: optional

-Which degree programme is responsible for the course?
Master's Programme in Theoretical and Computational Methods

-Which module does the course belong to?
TCM300 Theoretical and Computational Methods, Advanced Studies
PAP3002 Particle Physics and Cosmology, Advanced Studies

-Is the course available to students from other degree programmes?
Yes

4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)

Master's level, degree programmes in medicine, dentistry and veterinary medicine = secondcycle degree/EQF level 7
Doctoral level = third-cycle (doctoral) degree/EQF level 8

-Does the course belong to basic, intermediate or advanced studies (cf. Government Decree on University Degrees)?
Advanced studies

5. Recommended time/stage of studies for completion

-The recommended time for completion may be, e.g., after certain relevant courses have been completed.

6. Term/teaching period when the course will be offered

The course is offered in the spring term, during IV period.

7. Scope of the course in credits

5 cr

8. Teacher coordinating the course

Esko Keski-Vakkuri

9. Course learning outcomes

- Description of the learning outcomes provided to students by the course
- See the competence map (<https://flamma.helsinki.fi/content/res/pri/HY350274>).

The student knows the methods of second quantisation in non-relativistic many-body quantum mechanics and can apply these. The student can quantize free boson and fermion fields. The student can quantize electromagnetic field and apply the theory to describe interaction of quantised matter and radiation.

10. Course completion methods

- Will the course be offered in the form of contact teaching, or can it be taken as a distance learning course?
- Description of attendance requirements (e.g., X% attendance during the entire course or during parts of it)
- Methods of completion

Course is completed either by submitted exercise problems and additional exam problems or alternatively by a final exam.

11. Prerequisites

- Description of the courses or modules that must be completed before taking this course or what other prior learning is required

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12. Recommended optional studies

- What other courses are recommended to be taken in addition to this course?
- Which other courses support the further development of the competence provided by this course?

13. Course content

- Description of the course content

Many-particle methods in non-relativistic quantum mechanics

Elements of quantum field theory.

Quantum theory of radiation.

14. Recommended and required literature

- What kind of literature and other materials are read during the course (reading list)?
- Which works are set reading and which are recommended as supplementary reading?

F. Schwabl: Advanced quantum mechanics.

15. Activities and teaching methods in support of learning

- See the competence map (<https://flamma.helsinki.fi/content/res/pri/HY350274>).
- Student activities
- Description of how the teacher's activities are documented

Weekly lectures, independent work of the student, solutions to exercises will be submitted weekly and graded by the teaching assistant. The exercise problems are solved working in groups in tutored exercise sessions and also independently.

16. Assessment practices and criteria, grading scale

- See the competence map (<https://flamma.helsinki.fi/content/res/pri/HY350274>).
- The assessment practices used are directly linked to the learning outcomes and teaching methods of the course.

The grade is determined in a way agreed in the beginning of the course.

17. Teaching language

English