TEK/NAT Kursrapport

Kurs	*Kurskod*	*Poäng*	*År*	*Start v.*
Kvantmekanikens grunder	5FY157	7,50	2021	36

Institution	*Antal registrerade (män/kvinnor)*	*Antal aktiva studenter (deltagit i minst en examinerande del)*
Institutionen för fysik	6 (4/2)	-

Genomströmning (i %) och betygsutfall efter första tillfälle för examination (för varje betyg som satts på kursen ange antal som uppnått detta på formen ???

Genomströmning: 50% Betyg: G(2) VG(1)

Hur mycket schemalagd lärar-/assistent-ledd tid har studenten tillgång till på kursen?

66 hours

Hur är undervisningen upplagd?

24 Lectures (Pre-recorded)
7 Problem solving/presentation sessions (zoom or on-campus)
1 Lab (on-campus)

För vart och ett av lärmålen (FSR:en) i kursplanen, beskriv kortfattat hur det examineras.

redogöra för kvantmekanikens grundläggande begrepp och postulat, såsom hermitska operatorer, Hilbertrum, superpositionsprincipen, sannolikhetstolkningen och Schrödingerekvationen, samt kunna beskriva och härleda centrala resultat såsom t.ex. osäkerhetsrelationen och egenskaper hos egenvärden och egentillstånd för hermitska operatorer

tenta

redogöra för kvantmekaniskt rörelsemängdsmoment och spinn samt kunna härleda centrala resultat om dessas egenskaper

tenta

beskriva egenskaper hos system av identiska partiklar

tenta

härleda och redogöra för väteatomens struktur, inklusive dess finstruktur

tenta

redogöra för tidsoberoende störningsräkning samt kunna härleda korrektioner av energier och vågfunktioner

tenta

redogöra för tidsberoende störningsräkning samt kunna härleda övergångssannolikheter för enklare fall

tenta

lösa kvantmekaniska problem i en dimension med tillämpningar på bl.a. tunnlingsfenomen och harmonisk oscillator

tenta

tillämpa stegoperator,

tenta

genomföra beräkningar på väteatomen och andra sfäriskt symmetriska system

tenta

genomföra beräkningar på enklare system med spinnande partiklar

tenta

applicera tidsoberoende störningsräkning på olika system

tenta

applicera tidsberoende störningsräkning på enklare fall,

tenta, inlämningsuppgift

utföra mätningar på atomära spektra samt analysera egenskaper hos dessa

tenta, laboration, muntlig redovisning

kommunicera resultat av experiment och presentera erhållna resultat i skriftlig och muntlig form

laboration

visa samarbetsförmåga med andra personer i laborativ miljö

laboration

reflektera över och värdera sin egen insats vid laborationsarbete

laboration

Beskriv hur betygssättningen på kursen fungerar. (Vilka betyg ges på kursen och hur sker bedömningen, dvs vilka delar betygssätts och hur vägs de samman? Finns det skrivtliga betygskriterier och/eller lärmål (FSR) för de olika betygen?)

Samläses denna kurs med andra kurser??

Ja

Om ja, hur många?

Hur stor andel av kursen samläses?

94%

Samläser flera program denna kurs?

Nej

Om ja, hur många?

Arbetar studenterna i projektform på kursen?

Nej

Om ja, uppskattad omfattning i poäng på projektdelen:

Antal projekt som varje student deltog i:

Antal studenter i projektgrupp:

Förväntades studenterna använda en projektmetodik för dokumentation och styrning (tex LIPS)?

Nej

Hur skedde indelning av studenter i projektgrupper?

Har studenterna uppmanats föra projektdagbok?

Nej

Om ja, Har dagboken utgjort grund för examination?

Kursens samverkan med forskning

Lärare som bedriver forskning (>25% av tjänsten) är aktiva på kursen

Annan samverkansform, nämligen:

Kursens samverkan med näringsliv eller offentlig verksamhet

Ingen samverkan med näringsliv/offentlig verksamhet förekommer på kursen

Annan samverkansform, nämligen

Genomförda förändringar till detta kurstillfälle

- The lecture #1 was updated with an overall overview and motivation of QM, and better description the Schrodinger equation with some historical perspective.
-Various historical research articles were given as an additional and optional reading describing the development of quantum mechanics.
- Summary for the lectures was improved was previously seen, and the aim of lectures was specified at the beginning
- Updated structure for several lectures later in the course, in particular those regarding spin angular momentum.
-Reduced workload regarding the problem solving sessions. Only 3 problems where given to the students each session, instead of 4.
-The recommended problems were revised, new problems were added to lectures near the end of the course. Also some long and tedious problems were removed.

Förändringsförslag från föregående kursrapport

-Some later topics/chapters need more recommended problems
-Add recommended problems from different sources
-Improve problem solving sessions (engage students in the lecture)
-Adapt the presentation problems to allow time for discussion, and provide feedback to the students
-Improve details on the on-line lectures (board spacing, letter size,...)
-Be clear with he aim of the lecture

Lärare

Information om inblandade lärare

Kursansvarig

Eduardo Gracia

Antal övrig personal som ej föreläser

3

Antal övriga föreläsare

0

Hur stor del av den schemalagda tiden på kursen undervisas av forskande lärare (dvs lärare med mer än 25% forskning i sin tjänst)?

100

Hur stor del av den schemalagda tiden på kursen undervisas av lärare verksamma i näringsliv/offentlig verksamhet (dvs lärare med mer än 25% av sin tjänst förlagd till näringsliv/offentlig verksamhet)?

0

Kursvärd.

Totalt antal svarande

29

Sammanställningsdatum

2021-13-11

När genomfördes kursvärderingen?

Efter genomfört första examinationstillfälle

För varje lärmål på kursen ange hur stor del av de studerande som uppger att det har behandlats på kursen - ange svaret i procent på formen
har behandlats/har inte behandlats/vet ej

redogöra för kvantmekanikens grundläggande begrepp och postulat, såsom hermitska operatorer, Hilbertrum, superpositionsprincipen, sannolikhetstolkningen och Schrödingerekvationen, samt kunna beskriva och härleda centrala resultat såsom t.ex. osäkerhetsrelationen och egenskaper hos egenvärden och egentillstånd för hermitska operatorer

29 (100%)

redogöra för kvantmekaniskt rörelsemängdsmoment och spinn samt kunna härleda centrala resultat om dessas egenskaper

29 (100%)

beskriva egenskaper hos system av identiska partiklar

29 (100%)

härleda och redogöra för väteatomens struktur, inklusive dess finstruktur

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redogöra för tidsoberoende störningsräkning samt kunna härleda korrektioner av energier och vågfunktioner

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29 (100%)

tillämpa stegoperator,

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kommunicera resultat av experiment och presentera erhållna resultat i skriftlig och muntlig form

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29 (100%)

reflektera över och värdera sin egen insats vid laborationsarbete

29 (100%)

Sammanf.

Sammanfattning av åsikterna i kursvärderingen - positivt och negativt kring föreläsningar, seminarier, grupparbeten, laborationer, examination etc

This year the lectures were mostly pre-recorded, with the exception of some problem solving sessions, where zoom or on-campus teaching was used.

Q. To what extent have the lectures aided you in your learning? (5 -very much, 1 - not at all).
4.1

Q. How can we improve the lectures in order to facilitate your learning?
-Interactive (though obviously not really possible online)
-Go back to on campus lectures
By having face to face classes
-They were very good!
-The lectures were all good in my opinion
-There is honestly too much information in the course. The tempo on the is therefore too high so it is difficult to get an overview of what we are doing.
-The basis things such as operators or basic formulae were not so much explained, it was quiet difficult as I've never seen anything of what we saw in the course. It was really fast and a lot of calculations, but as some of us didn't understand the basic things it bas really difficult to understand the course ...
-More examples please
-I liked the fact that they were videos so we were able to review them I take our time for understanding
everything, if I have to say something to improve I would say in some points in the final stage of the course I would have appreciated more carefully explanations taking the time for looking at every even basic maths (so maybe is helpful when the course stars to get more difficult).
-I think that recorded videos should not be fast forward when you are writing on the board.
-avoid long lectures and maybe have some pictures when you talk about somthing abstract in order to simplify

Q. Do you have any suggestions for teaching methods which you think would benefit you in your learning? E.g. discussion sessions, seminars, group problem solving sessions, etc.

-more regular summary sessions
- Working in group, more group discusses would be nice. Group problem solving sessions
You need to improve the problem solving sessions. They we're quite pointless to be honest because solving two problems is just an extension of the lecture to me. Instead I suggest you solve one problem and spend the rest of the at helping with questions about recommended problems.
-I think problem solving sessions online in general are pretty bad, it doesnt really promote discussion as well, having them on-site would be much better but I know that wasnt possible during this period. Plus its easier to ask questions when you're meeting in person.
-laboratory helped me understand (because I talked with the professor and with only two other students). I think
-Group problem solving sessions would be great! It wold help tremendously to understand the concepts clearly and gives chance for discussions to arise if a concept has been ambiguous for some
-Group solving sessions would be nice, especially in a similar situation to now where it is hard to get in contact with other students and learn from eachother.
-Group problem solving sessions are probably good, when there's no pandemic. Anything that lets us try to calculate and at the same time get some feedback, hints and suggestions from others can be very helpful.
-Add more lab session.
-More examples on how you solve problems
-I would love to have one more lab experience with the same in depth discussion about it (and definitely with the same aims and way to teach the experiment)
-Going through the recommended problems somehow, either during a group problem solving or in additional lectures
-Group problem solving sessions

Q. To what extent do you think the problem solving sessions have benefitted you in your learning? (5 -
very much, 1 - not at all).
2.7

Q. Is it helpful for you to watch the teacher solve the problems? Can we arrange the problem solving sessions in any other way which would be better for your learning?

-It could have benefitted from being a bit more interactive. Maybe divide the class into random groups and let the groups try to since the problems first and then see where people had trouble advancing in the exercises and go through those steps more
-If there is time, I like the kinds of problem solving sessions where the problems are not from the book.
-The students can then try to solve them on their own for a short while, with the help of the teacher, and then at the end of the lecture the teacher can show the class how to solve it.
-I feel it is helpful if and only if I myself tried the problem first. I would prefer if as many as possible problems were presented, prefering quick walkthrough of many small problems, over a slow walkthrough of a couple huge problems.
- Its probably more helpful to have the sessions in school and to have the teacher solve the problems on the board instead of reading it from a paper.
-Resolve the problems together (teacher and students) and EXPLAIN the results.

Q. To what extent the student presentation sessions (including the preparation) beneficial for your learning? (5 - very much, 1 - not at all).
4.1

Q. What is your opinion about the student presentation sessions? (Did the preparation and the sessions benefit you in your learning?)

-It is a very good and useful thing to do
-Very good but a little bit long preparation time. But very helpful.
-The problems were very good to solve, it felt like you got a better understanding of most of the subjects
-They were good
-That's helpful.
-It's really stressful but it helped me to understand some points of the course (but more than one week to preparen it would be nice)
-Yes, very much so!
- In depth problem solving, such as during the presentation preparation, always seem to give me a better

understanding of the material than normal problem solving. I also like to work in groups and pairs as I learn much from discussing the material with others.

Q. How can we improve the presentation sessions?

-Either make everyone hand in their solutions or no one, it doesn't seem fair that you either present orally and written or nothing at all
-Maybe you could do smaller groups so that everyone had to present something? It would make it more fair, but also require a lot of more work and time from teachers, so I realize that might be impractical.
-I would like if solving the problems rightly wasn't the point and the focus would be reaching an interesting g solution which shows that the student work on it (the pressure was the only negative point for me)
-Maybe everyone should take part in the session

Q. What is your overall opinion about the experimental lab in regards to your learning? (5 - very good, 1 - very bad).
3.9

Q. What can be improved about the labs?
-The preparatory questions were good! We had Etienne as our supervisor for the lab and he helped us grasp the subject by explaining the concepts really well and asked us questions that made us think more about the subject instead of just asking for the correct answers.
-Do more lab session in order to practice more and understand better the course with concrete examples.
-The discussion before the lab about the problems were very good and should not be change. I like the lab
Etienne Auroux was a good supervisor. However, it was impossible to communicate with the other supervisor.
-Nothing I liked everything mostly the discussions the one previous to the experience and the one after.
I liked the lab and that we were forced to be well prepared beforehand. But I wanted a more clear description of how we should have presented our results at the end.
-The lab instructions should be clearer to do ALL problems beforehand, we had to spend extra 6h on the lab because apparently you have to do the problems that comes after the instruction says "so now we can check the problems with supervisor to see if they are correct and set up the experiment".. 6h additional time

Q. What is your opinion of the book?

4.6

Q. What do you think about the recommended problems? Did they cover all the material? Should some problems be removed /added?
-Too difficult to solve on your own in general. Solutions would be good to have.
-Yes they were good, it felt like it covered the most important parts
-They covered the material well
-The were good!
-They were okay
-They were good
-yes
-I didn't do all of them, but I felt that they covered the material pretty well.
-Did not have time to solve all of the recomended problems so i do not have so much to say
-I think they cover all the material !
-That was the thing I liked the least they were too many and some felt like I was going through not very important information also there is too much work to solve all of them in the final stages of the course where everything is harder and we have more work to do
-Did not do many recommended problems.

Q. Did you solve any additional problems except for the
recommended problems (and problems from the old exams)?

No (80%) Yes (20%)

Q. Please let us know if you have any additional comments about
the course!

-I really enjoyed the course
-It was overall a very good course with interesting concepts, very good job Eduardo!
-The course was great.
-As I said, the course was really fast. I'm a foreign student so it was difficult to understand a course like this while learning another learning method. By the way Eduardo (you I guess) is a really nice teacher and passionate ! I'm glad to met you :)
-Eduardo really made the subject very interesting and engaging with his enthusiasm for quantum mechanics! I've talked to a lot of people who have read this course earlier and only heard good words about it. It is of course a difficult subject and somewhat difficult to comprehend but I think that it was executed in a fantastic way!
-Maybe try to not send out emails on evenings and weekends if it's not absolutely necessary. It adds to the stress if you're constantly reminded that you should study. However, it's great that you answer questions so fast!
- No additional comments, the course was very interesting (quite difficult because it was my first time with
quantum mechanics but a very nice course).
- Its a very intresting course but i feel like i missed to learn alot of the material. Mostly to lack of time and since its hard material
- I really enjoyed it!!! Thanks for the course and congratulations.
- What got me intrested in QM before even starting Teknisk fysik was Schrödingers cat and other paradoxes. Would've liked to seen more of those thought-experiments. It keeps the motivation up for me atleast. I think Schrödingers cat had 10 min of time during the lectures :(
-In lecture 31, it colud be more inressting if you have pictures about what did you say for ex sc's catt and the box etc .....
Also about the credit for student presentations, I prefer if I could to get them Individual on canvas if it possible.

Lärarnas synpunkter på kursens innehåll och genomförande

It is clear that the problem solving sessions need to be improved. So this will be the aim for the following year. Other aspects of the course seems to be ok, so most of the efforts will be put on the problem solving sessions.

Note that the we already have in average 3 lectures per week, if more lectures are added as problem solving sessions or as presentation sessions, then the work load will increase significantly, since in particular these sessions are more demanding for the students.

Förslag till nästa kurstillfälle - ange vem som ansvarar för förändringen

-Improve the problem solving sessions, how??
-----Approach 1: Adding more sessions, so we can take less problems per session and explain in detail better.
-----Approach 2: Students (in groups) and teacher solve problems together. These sessions are significantly slower so various sessions might be needed
-----Approach 3: I dont know. But Approach 1 and 2 does not seems to be the best way, so I will think on something else.

-Revise the lab instructions for inaccuracies.

-At least one more lecture will be added to cover the basic concepts of eigenfunctions, matrices, and other minimum required algebra for the course. Several students have difficulties with this part, slowing down their progress significantly.

Bör kursplanen ändras till nästa kurstillfälle - vem ansvarar i så fall för att förändringen görs?

No

Granskn.

Granskare lärare (CAS-identitet)

eded0002 [Eduardo Gracia]

Granskare student (CAS-identitet)

lima0428 [Linus Martin]

Granskare studieadministratör (CAS-identitet)

gaaaln03 [Gabriella Allansson]

Eventuella kommentarer på granskningsprocessen