Course analysis: SK2901 Quantum Materials and Devices, 7.5 hp, period 2, 2020

Course data

Registered students:	36	
Teachers:	Ilya Sychugov, course responsible, 14 lectures	
	Jan Linnros and Apurba Dev, 1 invited lecture each	
	Sara Cavallaro, PhD student, tutorials	
	Adil Baitenov, quantum dot lab	
	Fredrik Stridfeldt, quantized conductance lab	
Examination results:		
TEN1, 2019-01-13	26 passed, 3 failed, 7 did not attend	6.0 hp
TEN1, 2019-04-16	-	6.0 hp
LABs	30 passed	1.5 hp
Mini Project	24 participated (not compulsory, bonus for exam)	0 hp
Two control exams	29 participated (not compulsory, bonus for exam)	0 hp
Full course	26 passed	
Overall examination	90 % (after first exam)	

General about this year's course

This year the course responsible/lector changed and some lecture material was readjusted, but still based on the same book. The mini-projects and control exams were voluntary and could add up to 25% of the maximum exam score. Both lectures and tutorials were run in a hybrid mode (zoom/on site), which shifted to online only by the end of the course due to stricter restrictions by December.

The number of students increased slightly this year to 36 (2019: 33). Students were mostly from Nanotechnology program but also from Engineering Physics and Materials Science.

There was a guest lecture by Apurba Dev on biosensing and by Jan Linnros on single electronics.

Approximately ~20-25 students on average followed the 8 tutorials which included 2 control exams (one hour each). Seven tutorials (2 hours) consisted of the discussion/solution of 4 exercises taken from the course book with additional exercises given as homework. The last tutorial consisted of the solution of exercises from previous exams.

There were 2 labs: (i) Quantum dots and (ii) Quantized conductance. Lab reports were corrected.

Student evaluation

A student evaluation using Canvas was performed. About half of the examined students answered (14/29) and the general evaluation was positive: good (4) or very good (10).

Very good	10 respondenter	71 %
Good	4 respondenter	29 %
Medium		0 %
Poor		0 %
Very poor		0 %

Examples of responses are given here for each question:

- Main impression. Positive: “interesting, inspiring, contemporary, very good, best in Master’s, structured”. Negative: “broad study material, difficult, time-consuming, hard for those without knowledge of quantum mechanics”
- Text book and course material. Positive: “useful, detailed, helpful, nicely explained”. Negative: “assumed the reader knows some concepts, too much to read, last two chapters a lot of theory, some sections confusing”
- Lectures. Positive: “well organized, always prepared, handwriting way better than slides, systematic, very interesting on applications”. Negative: “sometimes unclear video on zoom, fast pace, wish they were more focused on hard parts, more visual aid for better understanding of theory could be better, record and upload lectures and not only lecture notes”
- Tutorials: Positive: “helpful, taught and explained well, good”. Negative: “more explanations on each solution, more tasks, tasks from old exams are different from this year, sometimes were running in front of theory”
- Labs: Positive: “clear, very interesting, nice to let us to take active part in experiments, helpful TA”. Negative: “QC lab was quite difficult and time-consuming, more specs on what is expected in the report, one computational lab would be nice to have, wish more labs closely connected to the core of the course”
- Control exams. Positive: “helpful, useful for preparation to exam”. Negative: “arrange one more for the last two chapters, would be better to conduct control exams in December, quite easy, add more questions on theory part, more clear marking of the mistakes in grading”
- Exam. Positive: “good, hard but on the same level as teaching, as expected”. Negative: “5 hours is quite long – count control exams and exclude those topics for the final one, last two calculation tasks are too difficult, more clear explanation, let students use digital version of the book, too much points given in the theory part, question 4 is unclear, harder than the older exams, mini-project questions should be substituted because we did not have access to this material, stressful to make exam online”
- Mini project useful: “Yes (10)” “Did not participate (2)” “No (2)”
- Further comments: “more teacher student interaction”, “not good to have mini-project related questions in the exam”, “includes repetition of some topics as in previous course such as Solid State Physics”, “excellent course”, “hard parts of the course were not given much time and emphasis”, “make control exams and mini-project presentations mandatory”

Changes to next year

For next year the course shifts to period three, so it will be in calendar year 2022. Ilya Sychugov will take over the course completely.

The textbook (“The physics of low-dimensional semiconductors”, by John A. Davies) has been the same now for the 15 years the course has been given. Thus it would be time to shift to a more updated textbook since many topics are not considered in this book (e.g. quantum dots, nanowires, single electronics…). On the other hand, the book is very pedagogical building on Solid State Physics course books. The plan is to find another textbook, or to complement it with another study material.

Individual comments as stated above should be addressed.

Summary/Conclusion

This year the course had ~36 students. About half of examined students got A/B grades, which is a good performance. In general the course seems to be well appreciated but it is considered as hard for students without proper physics background. At the same time for those with strong background in solid state physics, quantum mechanics, etc. introductory lectures are not so interesting. So it is not easy to keep the difficulty level balanced for the whole group.

In the near future, the course should be updated with maybe a new text book, maybe one more lab and maybe more tutorials.

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Ilya Sychugov