Course analysis: SK2901 Quantum Materials and Devices, 7.5 hp, period 3, 2024

Course data

Registered students:	29 (26 first time registered)	
Teachers:	Ilya Sychugov, course responsible, 14 lectures	
	Anand Srinivasan and Apurba Dev, 1 invited lecture each	
	Juan Carlos Rivera Hernandez, PhD student, tutorials	
	Ilya Sychugov, quantum dot lab	
	Tanguy Schetelat, quantized conductance lab	
Examination results:		
TEN1, 2024-03-08	13 passed, 6 failed	6.0 hp
TEN1, 2023-06-04	10 passed, 2 failed, 1 Fx	6.0 hp
LABs	23 passed, 1 failed	1.5 hp
Mini Project	14 participated (not compulsory, bonus for exam)	0 hp
Two control exams	22 and 17 participated (not compulsory, bonus for exam)	0 hp
Full course	22 passed	
Overall examination*	50 % (after first exam), 81% (after re-exam)	

**Number of first-time registered students, who passed the course until a given date, in relation to the total number of first-time registered students (values from Ladok)*

General about this year's course

This year the course was based on the same book, and both teachers and tutorial assistant were the same as in 2023, except for the new lab responsible (both in QC and PL labs). Both lectures and tutorials were run on site only. The mini-projects and control exams were voluntary and could add up to 25% of the maximum exam score.

The number of students decreased this year to 29 (2023: 40). Students were mostly from Nanotechnology program but also from exchange students (Erasmus etc.).

There was a guest lecture by Apurba Dev on biosensing and by Anand Srinivasan on nanophotonics.

Approximately ~15-20 students on average followed lectures and tutorials. Two tutorials included 2 control exams (one hour each). Seven tutorials (2 hours) consisted of the discussion/solution of exercises taken from the course book and some consisted of the solution of 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. Only four students answered, and the general evaluation was positive:

Very good	2 respondents	50 %	
Good	1 respondent	25 %	
Medium		0 %	
Poor		0 %	
Very poor		0 %	
No Answer	1 respondent	25 %	

Examples of responses are given here for each question:

- Main impression. “Very good course which introduces interesting topics starting from the basics and assuming only some basic knowledge.” “I think this course is really important for students who want to work in the quantum field since it opens the door for a lot of significant concepts.”
- Text book and course material: “The book was okay, it was written in a comprehensible way and provided the information needed. Only in the later part of the course, mainly electric and magnetic fields, I found the book to be too confusing compared to the learning material explained in class.” “Understandable, detailed and useful”.
- Lectures: “The lectures were well structured and I really enjoyed Ilya utilizing the blackboard instead of just showing slides. The lecture notes provided on canvas were also completely fine if one could not attend class”. “Helpful”. “Good enough”.
- Tutorials: “Good and straightforward”. “Cool”.
- Labs: “I enjoyed the labs, in particular the PL one. The lab manuals were good, maybe only the part explaining what was required for the lab report anaysis in Qc could be explained a little better. In particular i enjoyed making the lab report for the PL lab where the analysis part was very well structured and guided you while also allowing you to understand what you were doing and why. I would personally change the fact that the QC lab report is individual and make it a 2 people report like PL.”
- Control exams. “The control exams were useful for understanding where you stood regarding comprehension of the topics but I would have preferred if they were a bit more spread out and covering a slightly larger part of the material (e.g chap 1-2-3 for control exam 1, and 4-5-6 for the second).” “For example it made me realize that i needed to work a bit on the different potentials explained in the course.” “It's really good to help us understand more in the first half of the period.”
- Exam. “The exam was how I expected to be, in particular with respect to the level of understanding of the material. I really liked how some of the problems were more based on knowing how to perform standard procedures, e.g band diagram of heterostructures, while others required you to come up with your own approach, e.g reflection coefficient. I think that some theory questions, i.e. STM of QDs, were too specific but overall I think the exam was in line with what was expected”. “Conceptual questions were really difficult for me”.
- Mini project useful: “Yes (2)” “Did not participate (1)”
- Further comments: “While the application in industry was discussed, it would be beneficial to provide students with a broader view of their usage in various industries as part of the compulsory curriculum. Incorporating computations into the curriculum could enhance students' understanding.” “I attended only one of the guest lectures, and I found it interesting and a nice addition to the course”. “I think this course is really interesting because it teaches me a lot of important concepts in the field of quantum.”

Changes to next year

In response to previous year’s comments this year we have modified tutorials content and made corrections to the exam, clearly separating no-book theory from book-allowed calculation parts. No criticism about these points has been raised, so we will continue with the present practice.

The whole teaching crew will probably remain similar for the next year, except for the tutorial responsible. The main change would be to make QC lab reports done in pairs.

Summary/Conclusion

This year the course had less students than previously (29). Including re-exams, about a quarter 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 hard for students without a proper physics background. At the same time, for those with a 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.

Next year's course occasion will probably be the last in the given format, considering changes in the Nanotechnology program, where this course is planned to be merged with another one.

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