Course analysis for “Physics: Introduction to University Physics, with Optics, Waves and Quantum Physics, FYSA13” VT 2020

Course responsible: Lukasz Michalak

Teachers:
lecturers: Vincent Hedberg (optics and waves) and Lukasz Michalak (quantum physics);
exercise supervisors: Megha Gopalakrishna and Zhen Zhao;
lab supervisors, geometrical optics: Helen Edström, Lassi Linnala and Smita Ganguly;
lab supervisors, diffraction: Ahmed Alshemi, Tim Lewis and Ahmed Masaada;
lab supervisors, quantum physics: Tamires Gallo, Susanna Hammarberg, Harald Havir and Mattias Åstrand.

Number of students registered: 38 (in Ladok)

Course representatives: Leana Cazorla and Felipe Abedrapo

Grades: U – 5, G – 10, VG – 13, did not take the (ordinary) exam – 10.

About the course

The course was given entirely as a remote (distance) course, due to the COVID-19 situation. The following distance learning adjustments were applied:

- Two of the labs (geometrical optics and quantum physics) were replaced by digital labs off campus: students worked individually and were encouraged to contact their lab supervisors during set office hours (via Zoom); the diffraction lab was organized on campus with some adjustments due to COVID-19 (shorter lab periods, individual work instead of work in pairs, disinfection of the workplace).
- Lectures were replaced by video lectures and regular online office hours with the lecturers (asynchronous learning).
- Exercise sessions on campus were replaced by real-time online exercises (synchronous learning).
- The usual lists of recommended end-of-chapter problems were supplemented by interactive exercises in Mastering Physics and graded hand-in assignments; the Mastering Physics and hand-in assignments generated bonus credits added to the final exam results.
- The examination was run as three online exams for the three sub-courses, respectively: Waves (3,0 hp), Optics (1,5 hp) and Quantum Physics (1,5 hp). Respondus LockDown Browser, Respondus Monitor together with supervision via Zoom on side devices (smartphones) was applied to ensure a high level of security.
- The students were provided, on Canvas, with a detailed study plan for each week and day of the course.

Analysis

I. Summary of the course evaluations

Total number of responses: 21 (55 %)

Short summary of the results:

Overall the students were satisfied with the course: on the scale from 1 to 5 the lectures were graded with 3.8 (4.0 for optics and waves, and 3.6 for quantum physics), the exercise sessions with 3.8, the exercise problems with 4.3, the laboratory work with 4.0, the online communication and Canvas website with 4.0, and the examination form and content with 3.4. The students felt that the content and form of the course had made it possible for them to accomplish the learning goals of the course (4.0 ± 0.9).

The students appreciated especially the hand-in assignments composed of old exam problems (grade 4.8 ± 0.4), the on-campus diffraction lab (grade 4.3 ± 0.8), and the course website on Canvas (grade 4.2 ± 1.0). Several students (6 people, 29 %) expressed that the labs had been their favorite part of the course.

The video lectures were seen by a majority of the students: over 71 % saw many or all of the optics and waves lectures, for the quantum physics lectures the fraction was over 52 %. Almost 48 % of the students said that they would not have liked real time lectures instead of the prerecorded video lectures; and for the additional 24 % of the students, real time lectures would have worked equally well.

The exercise sessions and lecturers' office hours were poorly frequented (0-2 students each time, typically). The students appreciated nevertheless the possibility of teacher contact (grade 3.7 ± 1.2).

Mastering Physics was used by 2/3 of the students regularly or occasionally, and the tool received a rather high grade of 3.9 ± 0.9.

Some of the students would have liked a less complex examination procedure for the online examination (7 people, 33 %, expressed that wish; grade 3.1 ± 1.1 for the procedure – the lowest grade among the different course elements) and more difficult exam questions (8 people, 38 %; grade 3.7 ± 1.1 for the content).

Several students (4 people) would have liked to have more complicated example problems or *more* example problems in the lectures, especially for the quantum physics parts.

II. Comments and reflections from the teachers

The teachers feel that the course went very well, especially given the short notice of the transition into online teaching and the continuous updates of the university's and faculty's routines regarding the COVID-19 situation. For instance, the faculty's decision on the form of the on-campus diffraction lab was postponed until the end of April.

Many extra resources, initially not planned for the campus version, were added to enhance the students' learning and continuous motivation: recorded video lectures, hand-in assignments, Mastering Physics homework, a detailed study plan. Digital versions of two labs

were also added since the original labs were impossible to perform on campus. We are happy to conclude that all those resources were perceived as helpful by the students.

The exam results were very good (82 % of the students that took the exam passed it, and 46 % did so with distinction), significantly better than in the previous Optics and Waves sub-course of FYSA01 (typically 70 %).

The examination procedure was admittedly complex, as many students pointed out, but we felt it was necessary to ensure a high level of examination security: to prevent and/or discourage cheating and to make the exam results reliable. The learning curve was rather steep, both for the teachers/exam supervisors and for the students. To smooth out the process, we created and applied the examination procedure in collaboration with the FYSA14 teachers; the FYSA14 course being taken by the vast majority of the FYSA13 students. A rehearsal practice exam was also organized prior to the FYSA14 and FYSA13 exams, in order to address all the technical issues. In the course evaluation, the students point out that the rehearsal practice exam was very helpful and that the actual exams worked well thanks to it.

As for the difficulty level of the exam questions, we believe the questions were not easier when compared to the previous occurrences of the FYSA01 Optics and Waves or the FYSA01 Quantum Physics.

One thing that the lecturers feel was difficult in navigating the course was the lack of systematic feedback from the students throughout the course, as they never met them in group.

Technical difficulties due to the online form: not all the software was compatible with Linux (Mastering Physics, geometrical optics digital lab, Respondus tools), which two of the students had on their computers. Help was organized by the department for those students regarding the mandatory parts (lab and exam).

The lab supervisors for the on-campus diffraction lab consider the smaller-thanusual size of the lab groups to be a positive factor, enabling the students to obtain more feedback and help. However, the lab sessions were shortened and that caused some unnecessary stress.

As for the digital labs, the supervisors like the contents and find the digital labs to be a useful complement to the course. They do point out, and rightly so, that digital labs can never fully replace labs on campus, held with real equipment and real phenomena. The interaction with students was too low, which manifested itself in pour quality of a number of reports (erroneous explanations, incomplete reports). The lab supervisors suggest a mandatory lecture with an introduction to the specific labs and to report writing in general and/or making the contact with lab supervisors mandatory. For the quantum physics lab also creating a number of preparation exercises is suggested.

The exercise supervisors find the assignments well designed. In their opinion, the Mastering Physics homework exercises were good but challenging to the students. The supervisors consider the level of student-teacher interaction to be much lower than in the campus

setting, which agrees with the results of the course evaluation and with the reflections of the other teacher groups.

III. Evaluation of changes since last time the course was given

This was the first time FYSA13 was given, but more than 2/3 of its content corresponds to the content of the previously given Optics and Waves sub-course (part of FYSA01).

Compared with the previously given Optics and Waves sub-course, this course contained much more online resources, as it was held completely online (except for the diffraction lab which was organized on campus).

The diffraction lab received now much higher notes than during Autumn 2019.

IV. Suggestions for modifications and measures until the next time the course is given

Until the next time the course is given, more example problems will be added to the quantum physics lectures. We will also look more often for students' feedback on the course throughout the course, regardless if the course is given online or on campus.

This semester Mastering Physics was made free of charge by its publisher, Pearson – because of the COVID-19 situation. Given its helpfulness, it would be useful to investigate the cost of the tool: if we should recommend the students to buy it as a complement to the textbook (preferably in communication with the teachers of the other first semester courses) or if the department could finance that cost, especially if the course is given online again.

If the course is given online also next time, we probably cannot simplify the examination procedure, unless the university provides us with better, simpler but equally reliable, tools for online examination.

2020-10-02, this course analysis has been put together by Lukasz Michalak.

The course analysis is sent by e-mail to the director of studies: jan.knudsen@sljus.lu.se