SK2402 - Fundamental of Photonics
Course analysis HT 2020 (period 2)

Course responsible: Katia Gallo

Examiner: Katia Gallo

Teachers: Katia Gallo and Max Yan

                        Katia Gallo: 10 lectures

                        Max Yan: 3 lectures

Teaching assistants: Ashraf M. El Hassan, Halvor Fergestad and Alessandro Prencipe

Registered students. 6 M.Sc. students (3 TEFRM + 3 NANO and no TTFYM) and 4 Ph.D. students (SK2304) took the course this year.

Exam results. All M.Sc. students took and passed the final exam in January 2021, apart from one, who did not complete the course due to sickness. The final mark distribution was: 2 A's, 1 C and 2 E's.

Changes with respect to HT2019
All lectures, the two labs and the final exam were given remotely, via Zoom.

- **Lectures.** All Zoom-lectures (Max' and Katia's) were video-recorded and made available for the students on CANVAS after class, together with other relevant course material. Katia implemented flipped classroom for all her slots. To this aim, she recorded and posted on CANVAS new lecture videos and then ran flipped classes on Zoom at the designated lecture slots, with blended activities (further explanations, derivations and discussions of the lecture topic, quizzes and problem-solving).

- **Home assignments.** Two more problem tasks were added at the end of the course to make up for the absence of the written exam in January. Overall 6 problem tasks were distributed throughout the course, in 3 sets of 2 tasks each (6-29 Nov) (20 Nov- 13 Dec) and (4 Dec-3 Jan).

- **Lab1, simulations.** Due to technical problems experienced last year, we had already decided not to book a KTH computer room for this lab. The students installed COMSOL on their own computer and ran the simulations from home. Max held the lab-session on Zoom and it all went smoothly. Lab reports and individual feedback to the students were handled as before. Extra-support time originally reserved for the 20th of Nov was not used (not necessary).

- **Lab2, supercontinuum.** Three remote-lab sessions took place in the period 7-9 dec. The lab could not be implemented with physical presence as in previous years due to the pandemic. The TAs pre-recorded new videos performing the experiments in the lab. They also collected multiple data sets using slightly different measurement conditions. The lab instructions were slightly revised and all the material (videos, pre-lab assignments and quizzes) was made available in CANVAS. Remote lab sessions were then run by the TAs for groups of 2-3 students each. The TAs connected to Zoom from the lab, discussing the prerecorded videos and preparation material and running experimental sessions 'live' on the setup. Each student group received a set of experimental data to analyze and comment on in the written report. The TAs corrected the reports and arranged additional feedback sessions with each group on Zoom. The students were also given the possibility to further improve their reports with one last revision round before the final submission (for grading).

- **Final exam.** The final written exam was replaced with individually-scheduled oral exams in January, run on Zoom. In the exam the students were asked four questions: two of them related to their solution of the home assignments and two more, randomly picked from a pool of mentimeter-like quizzes covering the whole content of the course.

- **Grading.** Having removed the final written exam, the final grades were determined on a scale of 0-10 points, considering the sum of the scores gained by: solving home assignments (max 6 points), attending the flipped class lectures (bonus points: 0.1 per class) and passing the oral exam (max 4 points).

Course evaluation.

We collected more informal feedback from the students during the course (via Zoom and emails) and also at the end of each individual oral examination session. We also asked the students to participate in the course evaluation, for which we used the version of LEQ with 5 questions, to which we added 10 more of our own. 4 out of 6 students gave feedback. From the answers, we notice that the students who filled in the questionnaire:

1. spent on average 16 hours per week on the course
2. found that they worked with interesting issues (average 6.8 on a scale of 7)
3. found the course to be challenging in a stimulating way (6.5/7)
4. found they could practice and receive feedback without being graded (6/7)
5. found the assessment of the course to be fair and honest (6.6/7)
6. found they were able to learn by collaborating and discussing with others (4.8/7)
7. found they could get support if needed (6.3/7)

Moreover, the students appreciated the availability of all material and video recording online and liked the flipped classroom and quiz format, so we're going to keep that for the future, in a more structured form. The flexible format and the availability of all the material online allowed also the two students who joined the course halfway to catch up with the lectures they had missed and successfully complete

the course. This is however not advisable, and we should try and get the course advertised better in the future especially for students outside the Engineering Physics program, which are the current majority for the course. It is worth noticing also that 3 Engineering Physics students wished to enroll this course at the beginning but were not able to do that since they had already reached the maximum allowed number of credits in the TTFYM program.

The comments on the labs were also extremely positive: the students thought they were really well planned and enjoyed them, despite the unusual circumstances under which we had to run -lab 2 in particular – this year. For the future we plan to keep the additional lab2-demo videos produced this year and include them in the preparation materials to be used next year. This will help the students get better acquainted with the lab hands-on activities and gain deeper insights in the experiments in advance, which may allow them to make a better use of the time in labs performed in physical presence.

The best aspects of the course

According to the students were the home assignments, very approachable lecturers and nice labs. Therefore, we shall definitely keep the combination of additional home assignment tasks and oral exam (instead of the final written exam) as well as the final grading procedure implemented this year. We see a pedagogical value in this configuration, which allows a better distribution of the workload for the students and gives more opportunities for formative feedback. We also believe it contributed to the perception by the students of a more balanced grading of their efforts (see also item 5 on the previous page). More distributed 'check-points' and approachable teachers/examiners also release a bit of the psychological pressure of the final exam and at the same time increase the students' engagement during the course, i.e. when they can still get useful feedback and improve their performance in view of the final oral exam. This positive trend was also apparent from our own analysis of the exam outcomes.

Some advice from this years' students to future participants

- *"Spend time with Home Assignments as they are the best way to learn concepts taught in class."*
- *"Many of the course topics (that might seem to be dreadful) are pretty similar to other classic topics in physics, like the photonic bandgap and the electronic bandgap, the coupled wave theory and the two-level system in quantum mechanics. By referring to these classic topics, the course content will be easier to understand"*
- *"The homework assignments are very important to do early"*
- *"Make sure you are motivated for the course, because the workload can be important"*