

Course analysis IL2206 Embedded Systems 7.5 credits (Autumn 2023)

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1 Description of the Course Evaluation Process

All students were invited to participate in the KTH learning experience questionnaire (LEQ) with 12 questions. The LEQ summary also gives separate diagrams per gender, type of student, or disability. The LEQ also allows writing free comments. A course committee meeting was offered but could not be held since no students replied and registered for the course committee meeting.

2 Description of Meetings with Students

A course committee meeting was offered but could not be held since no students replied and registered for the course committee meeting.

3 Course Design

The course consists of 17 lectures (2h), 2 seminars (2h) and 3 laboratory sessions (4h). To pass the course, both the written exam (grades: A-F), focusing on the theoretical aspects, and the laboratory course (grades: P,F) have to be passed. The seminars were part of the laboratory course. The written exam also determines the grade of the course. The laboratory course focuses on the practical real-time aspects of embedded single-processor systems.

The role of the seminars has been changed in the current version of the course. In order to strengthen the laboratories and to allow more time for the theoretical part of the course, the seminars focused purely on the preparation of the laboratories.

The students borrow donated Intel FPGA boards, which they can use for the course. In the second laboratory, the students have to implement an application using a commercial real-time operating system (MicroC/OS-II). To finish the two laboratory tasks, three lab sessions are allocated. The course is the first one in the master program "Embedded Systems" with many international students.

The course has worked well in previous years. The course has been designed for around 100 students each year at the advanced level.

Due to the large laboratory part, the course requires a large number of laboratory assistants. This year we have used four PhD students to conduct the laboratory sessions.

4 The Students' Workload

According to the answers of the students in the learning environment questionnaire, the workload is reasonable. Most students work a little bit less than 20 hours per week, which is less than in previous years. This might be caused by the change of the seminars in the course.

5 The Students' Results

Students perform well in this master course. A clear majority of the students pass the written exam and the laboratory course.

6 Students' Answers to Open Questions

It is very difficult to summarise the answers to the open questions. Many students pointed out that the course was well organised and had interesting lectures and laboratories. The lecture notes were seen as a positive addition to the course.

7 Summary of Students' Opinions

The KTH learning experience questionnaire has been used for the evaluation. The questionnaire has 12 questions, where students give marks from 1 (strongly disagree) via 4 (neutral) to 7 (strongly agree). The questions are grouped into the following three areas.

Only 20 out of 92 students participated in the questionnaire, although the system sends several reminders to the students.

1. Meaningfulness - emotional level (Questions 1-6)

The course received very high marks in this area (between 5.8 and 6.3). According to the evaluation, students worked with very interesting issues (Q1: 6.3), and the course was challenging in a stimulating way (Q4: 5.8).

1. Comprehensibility - cognitive level (Questions 7-16)

Also in this area, the course generally achieved very high marks (between 5.6 and 6.6). Students viewed the course to have well-defined learning outcomes (Q7: 6.4). They found the subject and the presentation very understandable (Q10: 5.9, Q11: 6.6), where they could learn from concrete examples (Q10:5.9) and where the understanding of key points had high priority (Q11: 6.6). The course furthermore was regarded to have a good alignment between the learning activities and the intended learning outcomes (Q12: 6.2). Students are in general satisfied with the delivery of the feedback (Q15: 5.6) and regarded the assessment on the course as fair and honest (Q16: 6.8).

1. Manageability - instrumental level (Questions 17-22)

The course achieved in general very high marks (between 5.8 and 6.2) in this area. Students regarded their background knowledge as sufficient (Q17: 6.0) and could learn in a way that suited them (Q19: 5.8). They liked that they could collaborate and discuss with others (Q21: 6.2), and pointed out that they were able to get support when needed (Q22: 5.9).

The evaluation results did not change much from the previous years.

8 Overall Impression

In general, the course seems to run very good and students perform in general very well in the course. Also, students find the course interesting and think that the course has a good structure.

On the administrative side, the course requires a lot of resources and effort from the teaching staff because of the practical laboratories, where students can borrow FPGA hardware boards.

9 Analysis of the Learning Environment

It seems that the course has succeeded in creating a stimulating and positive learning environment for the students. This is particularly important because IL2206 Embedded Systems is the first course in the KTH master program "Embedded Systems" with depending on the study year between 80 and 150 students, where the major part are international students, who have never studied at KTH before. The course seems to have a clear organisation and structure, which is well aligned with the intended learning outcomes. Students view that the subject is presented in a clear manner and the assessment of the course is fair.

There are no big differences between the answer scores of international master, exchange and Swedish students. The evaluation of the male students (lowest score: Q4, Q15: 5.7, highest score: Q16: 6.9) showed more variance than the female students (lowest score Q15, Q19: 4.0, highest score Q17: 7.0). However, although there is a trend, it is difficult to draw deeper conclusions due to the low number of students answering the questionnaire. Not all questions received sufficient answers from the female students to be visualised in the LEQ graph.

10 Priority Course Development

Based on the LEQ results, from the student perspective, the course seems to work very well and can be given in the same form next year.

However, the laboratory course requires very large resources and effort from the teaching staff. Also, the number of working donated boards is decreasing, and since the boards are not in production anymore, they cannot be directly replaced. How the laboratories can run more efficiently has to be investigated because the current setup using a limited number of donated FPGA boards and a complex software structure is fragile and requires a lot of operational effort from the course staff.