

# Course analysis

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## General information

This document provides the course analysis about the master degree course

### Introduction to Signal Theory EQ 1210 and Signal Theory EQ 1220

given in the first period 2011/12. The course responsible was Tobias Oechtering, Communication Theory, EES, KTH. Email: [oech@kth.se](mailto:oech@kth.se), tel.: 08 790 8462. The course "Introduction to Signal Theory" covers the first 2/3 of the course "Signal Theory." Further, the requirements to pass the project and the difficulty of the exam are lower. The tutorials and projects were given/guided by the teaching assistants Hamed Farahdi (first 1/3 of the course & project 2), Efthymios Stathakis (second 1/3 of the course & project 1), and Frederic Garby (third 1/3 of the course & project 2), all PhD students in the Communication Theory Lab.

Course organization:

- 12 x 2h lectures
- 12 x 2h tutorial given in two groups.
- Two mandatory take home project assignments
- One written exam, 5h.

Requirements:

- Passed project assignments (PRO1: 1cu, PRO2: 1cu) , grading: passed/failed
- Exam (TEN: 5.5cu), grading: A-F

Material:

- Lecture notes: "Signal theory" by P. Händel, R. Ottoson, H. Hjalmarsson, and M. Jansson.
- Collection of problems in Signal Theory
- Old exams available at the course homepage
- The KTH table of signal processing formulas (in English)
- Two project assignments (made available online during the class)

## Statistics

Registration until Sept 15<sup>th</sup>:

- 33 students registered for the course EQ1220  
from programs: TTLSM<sup>1</sup>, TDIPM<sup>2</sup>, CMIEL<sup>3</sup>, TSCRM<sup>4</sup>, TELFM<sup>5</sup>, TIKTM<sup>6</sup>, CTFYS<sup>7</sup>

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<sup>1</sup> TTLSM: Masterprogram, Trådlösa system

<sup>2</sup> TDIPM: Masterprogram, konstruktion och realisering av IT-produkter och -system

<sup>3</sup> CMIEL: Civilingenjörsutb i mikroelektronik

<sup>4</sup> TSCRM: Masterprogram, systemteknik och robotik

(EQ1210) EQ120 (Introduction to) Signal Theory, KTH, Period 1, 2011, Instructor: Tobias Oechtering

- 7 students registered for the course EQ1210  
from program: CINEK TSIA<sup>8</sup>

All students have to do two homework project assignments which are allowed to be done in groups of at most two. The students have the opportunity to revise their project report after a first evaluation of the project report.

Project 1:

- EQ1210: 6 failed in the 1<sup>st</sup> round and 6 passed in the 2<sup>nd</sup> round.
- EQ1220: 23 failed and 7 passed in the 1<sup>st</sup> round and 23 passed in the 2<sup>nd</sup> round.

Project 2:

- EQ1210: 4 failed and 2 passed in the 1<sup>st</sup> round.
- EQ1220: 26 failed and 3 passed in the 1<sup>st</sup> round and 25 passed and 1 failed in the 2<sup>nd</sup> round.

Exam written on Oct 20<sup>th</sup>, 2011, 14:00-19:00: Results see *Section Exam results*

Re-exam written on Feb 4<sup>th</sup>, 2012, 9:00-15:00: Results see *Section Re-exam results*

## Course history and development

The course was previously given by Magnus Jansson, SP. I took over the course in the end of June 2011. I did not do any changes on the topics covered in the course. As in the years before, the course was given on the white board. Only, the course information and some general motivation in the first lecture and the final review and future study information in the last lecture were given on slides. I added/modified a few examples and derivations. I kept the course material, course book, problem collection, and project assignments. I introduced "KTH social" as a platform for exchange between students, TAs, and teacher. Two students convinced me to modify the tutorial style. In the "old style" the TA sometimes presented a brief repetition of the main principles and then the solution of some selected problems. In the "new style" the TA still gave a short repetition of the main principles, but then the students tried to solve the problems themselves in groups and the TA assisted where they had problems. If many groups had problems at the same step, then this issue was explained at the board to everybody in class.

## Course feedback

The questions and the answers can be found in *Appendix Course Evaluation Results*. On Feb 24<sup>th</sup> the teaching team had a course reflection lunch meeting where we reflected about the course and discussed about actions how to improve, in particular how to improve the activity level of the

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<sup>5</sup> TELFM: Masterprogram, elektrofysik

<sup>6</sup> TIKTM: Masterprogram, informations- och kommunikationsteknik

<sup>7</sup> CTFYS: Civilingenjörutb i teknisk fysik

<sup>8</sup> CINEK: Civilingenjörutb. i industriell ekonomi; Spår: trådlösasystem och industriell ekonomi

students. The following discussion and potential course development actions take the students and TAs feedback into account.

## Discussion

From small talks to students during the course I have realized that the students have very different pre-conditions and pre-knowledge. Some students know half of the material from their previous studies (e.g. bachelor studies at other universities) while for others everything is new and perhaps they even lack some required knowledge and/or motivation. This seems to be in particular the case for the EQ1210 students. The course can be considered as a *synchronization point* for newly enrolled students in KTHs master programs. Accordingly, an overlap of knowledge seems to be unavoidable. However, a lack of required knowledge would be a serious problem. This problem has to be investigated and if this problem turns out to be true, then corrective actions should be taken.

I introduced "KTH social" as a forum where students, TAs, and teachers could exchange. However, there were only a few postings from students, no discussion. Mostly the teacher and the TAs used KTH social to disseminate course information. In particular, the TAs provided there more detailed scanned solutions to the exercises which they did not present in the tutorial due to the new teaching style. It is questionable if the effort to run the KTH social page in parallel to the course homepage pays off.

During the course we changed the tutorial style. In the first two tutorial session the TA presented the solution to some selected problems. In the following sessions the TA tried the new style where the students solved the problems in groups and asked for help. I consider the new style to be more effective since the students are active themselves. However, this style requires that all students have the chance to participate. This might be critical if not all students have the same pre-knowledge or if some students are not integrated. Furthermore, the new style is more demanding, which requires competent TAs!

From our course reflection meeting of the teaching team we identified that students train for the problems in the exam, which got obvious from some exam solutions. To provide old exams is good for preparation, but we will remove the solutions so that students do not train the solution. Further, to increase the activity level, we discussed about quizzes in the beginning of the lecture and/or mandatory problem assignments combined with ticking in the tutorial. Both might be rewarded with bonus points in the exam. In any case, we agreed that changes should be done gradually, because the course is already highly developed.

## Possible actions for future course development

The following actions are suggested based on the experiences from the teacher team as well as the response from the students.

- Diagnostic test or questionnaire in the first lecture to see if the students have the required minimum pre-knowledge. Perhaps offer an extra tutorial to address deficiencies, e.g., basics in probability theory might be a topic.

- If a substantial difference in the pre-knowledge can be identified, then perhaps the students should be divided in two groups with different tutorials. Perhaps one has to offer extra tutorial for the weaker group to catch up. If the weaker group consists mainly of EQ1210 students, then as a first action perhaps the EQ1210 course should get its own tutorial, while the lectures are still done jointly.
- Ask for reflective journals during the lecture period to identify miss-conceptions. Possible implementation: Let the students reflect on the course so far – possibly a first one after the first 1/3 of the course and a second one due before the first project. They should discuss about the most important concepts and report about most difficult concepts. This provides feedback about troublesome knowledge and threshold concepts. First, I would suggest to make the journals voluntarily. To animate students to do them, I propose that a good reflection will be worth up to two extra points in the final exam (which usually will have around 50 points in total).
- To make the lectures more interactive, I propose to introduce short quizzes or “clicker” questions to check miss-conception directly in class. To generate more interaction, ask the same question two times before the correct answer is revealed. After the first round, the students see the voting, hear some arguments, or get some hints/explanation before they are supposed to discuss with their fellows before they are asked for an answer again. Further, I have good experience with “5-minute” exercises in class, where the students are supposed to directly apply the newly learned methods.
- Quizzes could be also used in the beginning of the class, which check if the students did the reading assignment. Regular participation might be rewarded with bonus points.
- In the lecture more examples and possibly in-class experiments/simulations should be done. To generate the time for that, results (theorems, remarks, etc.) which are stated in the course notes should be presented using slides. However, proofs, figures drawn for explanations, and derivations should be still presented on board.
- For the tutorial I suggest to continue with the “new style.” Thereby, it is perhaps important to ensure that all students work in groups. Possibly, the groups should be randomly generated. Thereby, the newly enrolled master students learn to know each other, which perhaps help them to learn from each other. In long term one might change the tutorial style even more to enforce participation, e.g., homework assignments, ticking in the tutorial.
- For the course material I propose to provide supplementary reading. I suggest finding more basic as well more advanced and elaborative material.
- For the projects, I propose to develop new projects for the EQ1210 students.
- For the course evaluation, I propose to ask explicitly concepts which were considered to be difficult. Further a question if they were enrolled in EQ1210 or EQ1220 should be included. This allows differentiating between them in the course analysis using the filter function.
- The use of “KTH social” has to be re-considered.
- Operational, the teacher needs to make clear to STEX that the results of the projects are reported to Ladok after the revision. There is no need to report a failure in the first round (which might be done in the first round to provide formative feedback to the students).

## **Overall evaluation**

I think that the course content, lecture notes, project assignments, and problem sets are of good quality. They can be possibly supplemented, but no major changes are necessary. However, I think that there is space for further improvement in teaching with the aim of a higher involvement and interaction with and between the students. Further, more examples and perhaps an in-class experiment/simulation might be helpful. I consider the handling of the suspected different pre-knowledge between of the enrolled EQ1210 and EQ1220 students as the main difficulty in this course. (Memorandum: Recently I got told by Mats Bengtsson that this issue will be solved on a program level.)

# Exam results

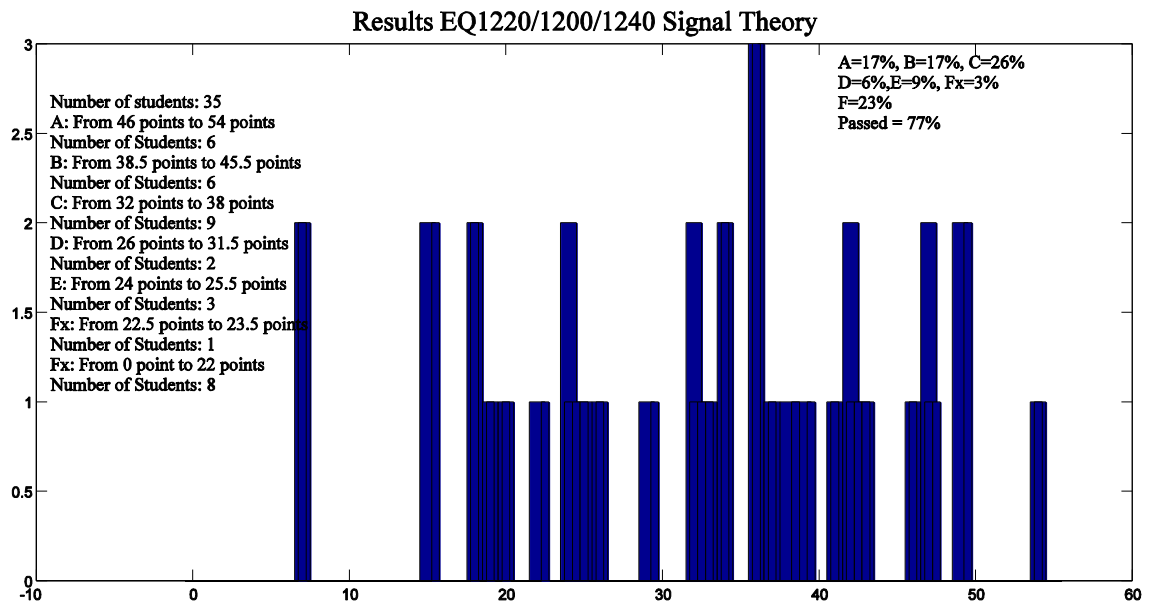
*Signal Theory, EQ1220, Fall 2011*

*Introduction in Signal Theory, EQ1210, Fall 2011*

Date & time: 2011-10-20; 14:00- 19:00

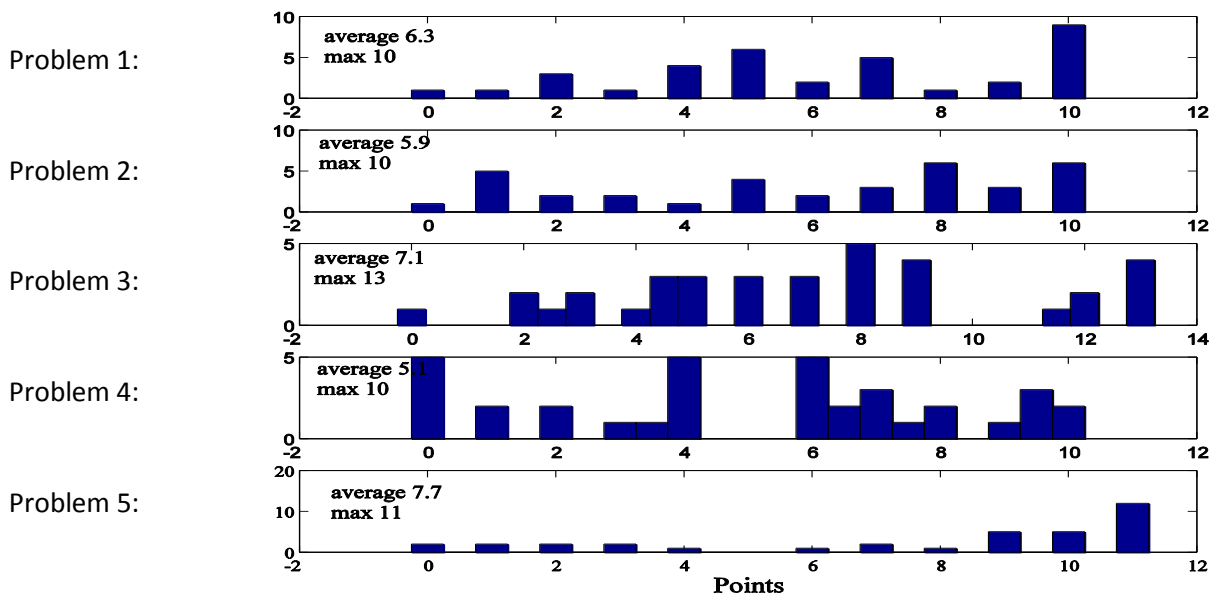
Number of students EQ1210: 1 who achieved a C with 25 out of 43 points.

Number of students EQ1220/1200/1240: 35



There was an oral exam for the FX student which he passed.

## Distribution between problems:



# Re-exam results

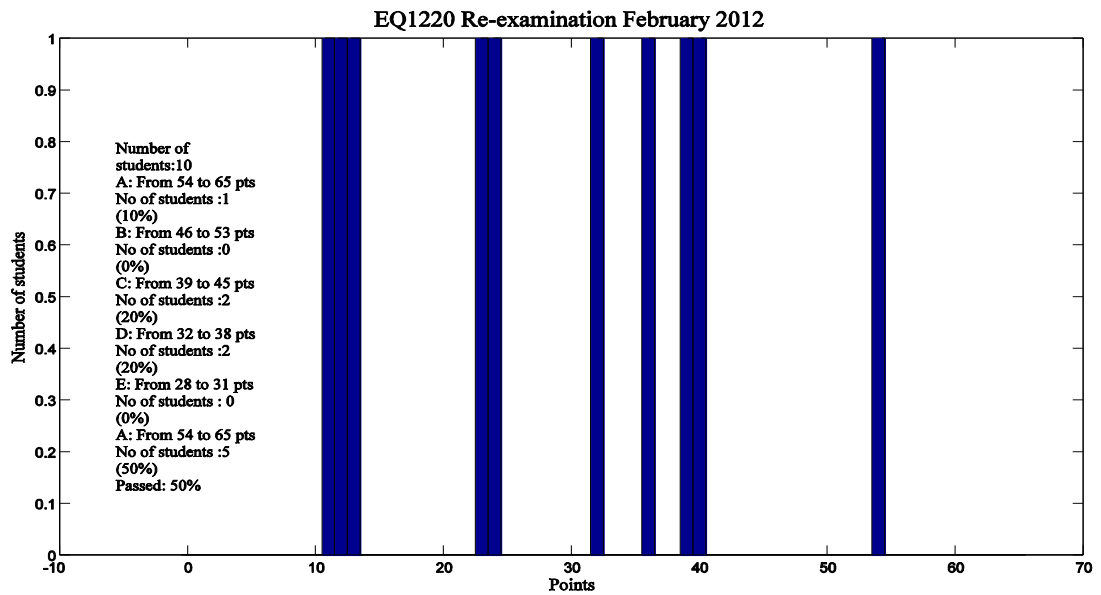
*Signal Theory, EQ1220, Fall 2011*

*Introduction in Signal Theory, EQ1210, Fall 2011*

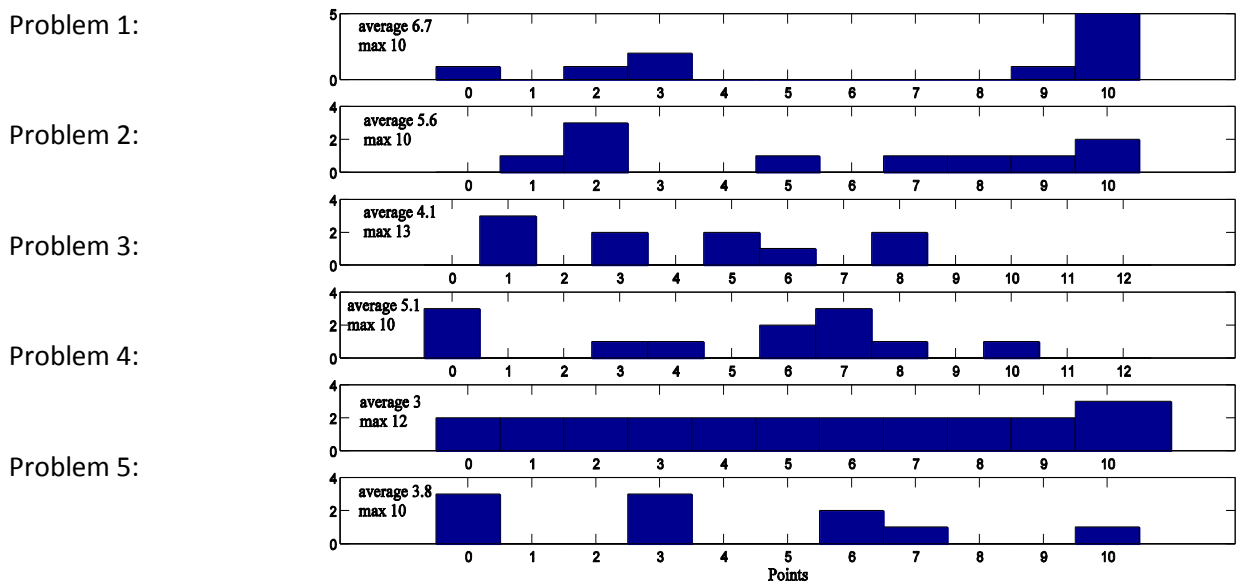
Date & time: 2012-02-04; 9:00- 14:00

Number of students EQ1210: 0

Number of students EQ1220/1200/1240: 10



## Distribution between problems:



# Course feedback

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*Signal Theory, EQ1220, Fall 2011*

Status: Avslutad

Publicerad under: 2011-09-30 - 2011-12-08

Antal svar: 15

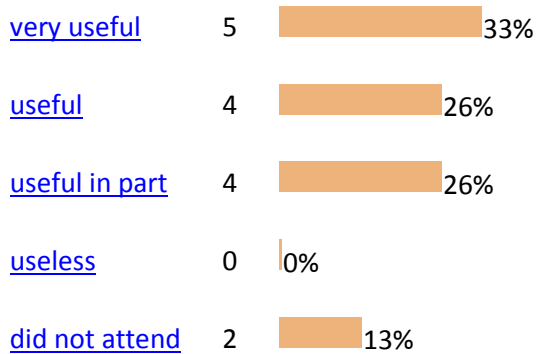
Procent av deltagarna som svarat: ?%

Kontaktperson: [Tobias Oechtering](#)

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## 1. How useful in learning the concepts were the lectures?

15 svarande



## 2. Comments regarding the lecture:





- [+ I liked that the course was taken on the board \(easier for me to follow than someone reading his slides\). Plus the course had a good pace. + the introduction at the beginning of each lecture \(what we will see during the lecture\) and the summary at the end \(what we have seen, what's next\). - more examples would be welcomed](#)
  - [The professor just copy in the blackboard what is it in the course book. Not much further information or even explanations were given.](#)
  - [We barely could follow on noting the notes the lecturer puts on the board, so there were less time to absorb and understand the information given.](#)
  - [The lectures followed a steady pace which allowed for understanding the concepts presented during the lecture.](#)
  - [It helped a lot when the teacher explained the concepts. Perhaps this should be done more often.](#)
- 

## 3. How useful in learning the methods were the tutorials?

15 svarande





<a href="#">useful</a>	6		40%
<a href="#">useful in part</a>	1		6%
<a href="#">useless</a>	0		0%
<a href="#">did not attend</a>	1		6%

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#### 4. Which tutorial style do you prefer? Why?

14 svarande

<a href="#">old style (1. &amp; 2. sessions)</a>	4		28%
<a href="#">new style (3. - sessions)</a>	10		71%

- *Its better to give in this style, but gives the reasons for every answer and steps. The new style, we can do it ourselves at home and emails when we have questions. (old style (1. & 2. sessions))*

- *I learn more if I get to figure out the math myself with hints. You also have the opportunity to (new style (3. - sessions))*

- *the new style was better to focus on the points that were causing problems (more "personalized"). (new style (3. - sessions))*

- *It's good to try to do exercises by yourself with the assistant's help. You first try to do it alone, or with your group, and if you have any problem you can ask the assistant, whose help was normally very useful. Besides, before and after every exercise some useful comments and hint in order to solve and understand the problem were given. (new style (3. - sessions))*

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#### 5. Comments regarding the tutorials:

- *very good overall. One minor problem of synchronization with the lectures at one point (around the middle I think)*

- *excellent tutorials, problems helped to understand the lecture's background in a better way, some problems were hard, however the hints were sufficient for solving the problems and a good recap of the lecture's contains as well*

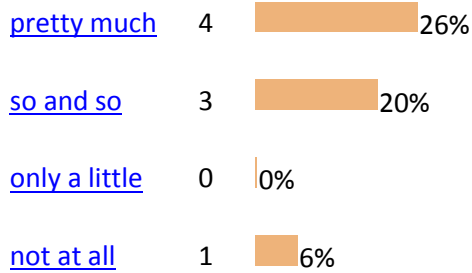
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#### 6. Do you have the feeling that the project required from you to learn or improve relevant skills (programming, report writing, etc.)?

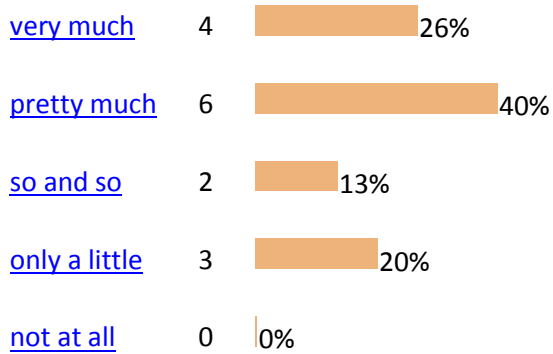
15 svarande

<a href="#">very much</a>	7		46%
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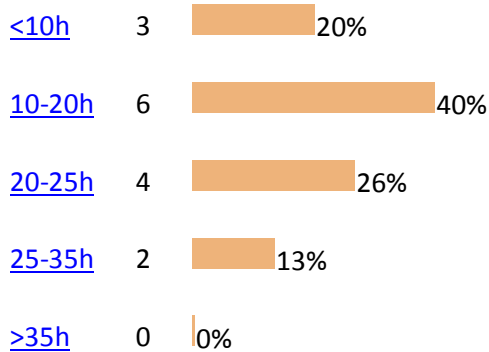
### 7. Did the project assignments improve your understanding of the material?

15 svarande



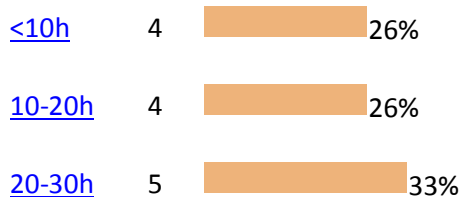
### 8. How many hours of work did you spend in project 1?

15 svarande



### 9. How many hours of work did you spend in project 2?

15 svarande



<a href="#">&gt;30h</a>	0	0%
<a href="#">ongoing</a>	2	13%

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### 10. Comments regarding the project assignments:

- Very fun, especially the second one.
  - Good way to practice the course. I liked the fact that very few indications are given on the way to solve the problem. This "freedom" forces us to try different approaches and manipulate the different tools of signal theory -> Interesting. Writing a proper report is a good exercise for the future.
  - I do think the projects are much more difficult than the level in lectures & tutorials. Besides, I personally had some problems to find the relationship between what was explained in tutorials and in the book and what we were asked to do in the projects. I also had some problems not in the concepts, but in how to implement and design the Matlab code in order to get the desired results.
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### 11. What do you think about the course notes?

15 svarande

<a href="#">excellent</a>	1	6%
<a href="#">good</a>	10	66%
<a href="#">so and so</a>	2	13%
<a href="#">bad</a>	1	6%
<a href="#">did not use</a>	1	6%

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### 12. What do you thing about the collection of problems?

15 svarande

<a href="#">excellent</a>	7	46%
<a href="#">good</a>	7	46%
<a href="#">so and so</a>	1	6%
<a href="#">bad</a>	0	0%
<a href="#">did not use</a>	0	0%

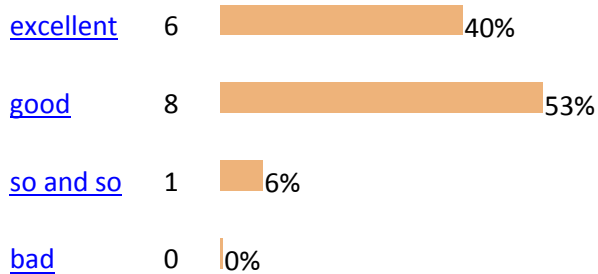
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### 13. Comments regarding the course material:

- [The example collection is good, but maybe a bit short on some of the chapters.](#)
  - [x](#)
  - [The course book is useful because it covers all the concepts given in the lectures, but I think it is not clear enough.](#)
  - [The course notes are hard to understand and gives not detailed information for getting the formulas.](#)
  - [okay](#)
  - [supplementary study material would be good](#)
- 

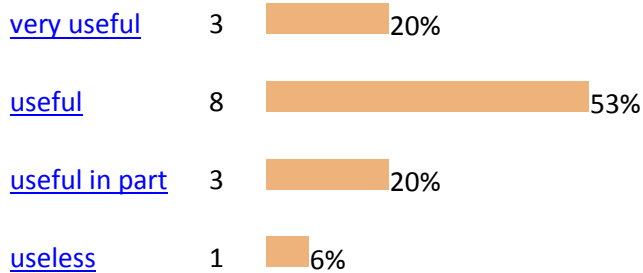
### 14. What do you in general think about the course information?

15 svarande



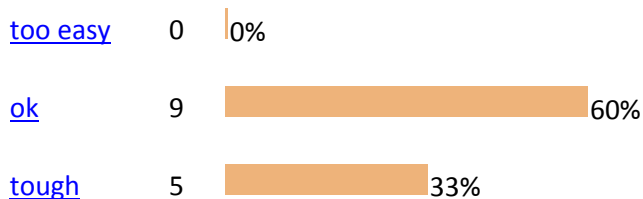
### 15. Do you consider the discussion group on KTH social to be useful?


15 svarande



### 16. How would you rate the level of difficulty of the course?

15 svarande



[too tough](#) 1  6%


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**17. Do you have the feeling that you have learned relevant concepts and methods which will be important for your future (studies)?**

15 svarande

[very much](#) 7  46%

[pretty much](#) 5  33%

[so and so](#) 2  13%

[only a little](#) 1  6%

[not at all](#) 0  0%

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**18. What was good and should not be changed?**

- [Projects](#)
  - [The exercise questions have an appropriate difficulty level and the fact that solutions are provided is very useful for learning the material. The project assignments were fun.](#)
  - [the new style of tutorials course on the board \(a mix board / slides would also work\) the projects](#)
  - [Tutorial sessions are helpful to understand the material.](#)
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**19. How can the course be improved?**

- [Small project problems in class too](#)
  - [It would have been nice with a hint to use fftshift for project 1. Took me some hours to find that out by myself.](#)
  - [more examples during the lectures](#)
  - [Improving the lectures by giving more practical examples and explanations, not just coping from the course book.](#)
  - [More explanation and examples, rather than writing the theory which is almost the same thing already in the textbook.](#)
-