Course Analysis
EI1120 Elkretsanalys för Energi och Miljö (CENMI program) 7.5p
VT16 P3 (2016-01-19 – 2016-03-22)
Nathaniel Taylor

Staffing
Responsible department: Electromagnetic Engineering (KTH/EES/ETK)
Course-responsible, Lecturer, Examiner: Nathaniel Taylor (writing this analysis)
Examiner: Daniel Månsson
Other teachers (övning): Mahsa Ebrahimpouri, Kun Zhao

Events
Lectures: 14 double-period sessions (i.e. 21h), two per week (but only one in the weeks where there's a KS-exam)
Tutorial (övning): 14 double-period sessions (21h), usually 1 day after lecture, free choice of two parallel groups
Laboratory tasks: 3 obligatory lab sessions, each taking 1 to 2 hours; an optional 4th session is offered near the end
Homeworks: 12 homeworks, submitted by email or paper; 6 are obligatory, doing more adds to bonus-points

Lectures and tutorials were generally well attended, i.e. the majority of the class (70–80% at a guess).
Almost all new students (~90%) kept up to date with the homeworks.

Registered students
This was the usual rather confusing mixture of new, old, registered, not registered, etc.
61 were registered as of 2016-01-22 in the "Anmälningslista" (KTH-Social), and 6 more were listed but not registered.
69 took the final exam in March (ordinarietenta):   A (2), B (18), C (14), D (10), E (8), Fx→E (10),   F (7)
5 took the re-exam in June: E (1),   Fx→E (2),   F (1)
82 students participated at some point during the course (KS1, KS2, exams, homework, lab).

Results
The same principle was used as last year: a final exam and two part-exams (KS) that can contribute to it.
Questions were in a similar style to last year.
Exam (ordinarietenta VT16) 2016-03-22: 69 students: A (2),   B (18),   C (14),   D (10),   E (8),   Fx→E (10),   F (7).
The pass-rate on this exam was thus 90% after Fx-completion.
Compare to earlier years (after any Fx completions):
    2015: 81 taking the exam: A (7),   B (21),   C (19),   D (20),   E (4),   F (10)   89% pass
    2014: 78 taking the exam: : A (22), B (26), C (11), D (11), E (3), F (5)   94% pass
Re-exam, June 2016-06-09:   17 students registered and 5 actually sat the exam: E (1),   Fx→E (2),   F (1).
Most students either passed all or failed all of PRO1/PRO2/TEN1, and most were new this year. Thus the proportion of available points (hp) obtained during this round is similar to the pass-rate of the exam.

Course "moments" and points
The course's 7.5 points are distributed between the final exam (TEN1, 5p) and two "projects" (PRO1/2, 1.0 & 1.5 p).
This year we were simple and strict for repeating students: they got the same conditions as new students. So if they did not already have a pass in PRO1 or PRO2 they had to do the respective lab or homework assignments. (Last year, re-registered students who had shown some course activity in a previous course-round were allowed to obtain all the course-moments through passing the written exam, according to the rules that were in place when they started.) The change simplifies the record-keeping *and* is hoped to give these students a better chance of passing the exam by having had to do the related tasks.

Course material
Just the same format was used this year as last year. Each lecture other than the first and last is the start of a new topic. For each topic the website has a PDF file describing the subject ("Chapter"), another with Exercises, and another with Homework, with solutions to homeworks published immediately after the deadlines. For each lab exercise the task description was provided on paper in the lab, and was available as PDF on the website beforehand; then a detailed summary was put on the website after the lab, for students to check their calculations against. Many past exams and solutions are also available on the course website.

        These online resources constituted the course material. No interest has been shown in having paper copies available. No suggestion was received that this core literature needed any supplement such as a book. However, this year there was a clear indication that the Chapters were found too long and text-filled, and that towards the last part of the course some Chapters were not so well structured. These chapters are first on the list for revision before the

next course-round.

The old KTH compendium (G. Petersson) is available on paper from the EES student office, and is recommended as a supplement for learning the Swedish terminology, doing further practice questions, and possibly as an alternative source for students who prefer its style – tastes in literature are very varied. A few other textbooks are also mentioned in case students wanted alternatives. No feedback has suggested that other textbooks have been used. However, it is clear that several students make use of online videos (from external sources) as a supplementary source of explanations and examples.

Changes that were made in this VT16 Course-round

The step from VT15 to VT16 had less change than between previous course-rounds. There was no fundamental change that was obviously desirable. Small incremental changes included splitting labs a little differently, updating the task descriptions, changing the homeworks, and adding further exercises. The course's basic format is stable and works.

Many large and small changes *could* doubtless be made for good reasons. Change has a cost in terms of my time, and of the students' comfort and confidence in judging the course's demands from previous course-schedules and exams; this cost needs to be justified. Last year's course analysis describes that several fundamentally different forms of the course would make sense for this program, given that most of the students will not even be using electrical skills to any extent in their further studies: for example, we could work much more with applications; and we could have design-projects, etc.

So far, the examined core has been kept quite abstract, as a base for later applied courses that some of the students will take. Applications have been supplementary (not examined), in the course introduction, guest lecture and in some exercises in the later parts of the course. I am not currently tempted to change this strongly, as I worry it could dilute the core calculation skills: time is very limited.

Evaluation

Desirous of getting a high response rate, a paper questionnaire was distributed in the final lecture, before the break. An announcement was also made via KTH Courseweb to request others not present at the lecture to fill the same form electronically and send it by anonymous upload. 28 responses were received by on paper, and 2 were uploaded. Thus, the response rate was in fact hardly better than last year, at rather under 50%. Some of the comments from the questionnaire are given as an appendix to this analysis.

A paper-based evaluation was made in the middle of the course also, to see if any changes would be useful: the main suggestions were about easily improved matters of speed, loudness and style of the teachers.

Next year I might use the KTH standard evaluation form, and no other. I have previously preferred more flexible evaluations where students write text instead of mainly clicking on numeric scales. Now that the course is quite stable and I'm not trying to get feedback on details of proposed changes, this matters less. (However, experience from the Elektro circuits course, EI1110, was that response rates below 30% were obtained for the KTH evaluation form too!)

Summary (my overall impression from the course and the evaluation responses)

As in several previous years, the overall impression is very positive, both about the student group and the way that the course fits them. There has been good, focused work: circuit skills and general skills have grown strongly. Uncomfortable workload has only been hinted at in one or two cases, and is a combination of two intensive courses. Particular features of the course design considered important for the positive impression are: regular homeworks, the style of the homeworks, division of work between two KS and the main exam, and a very clear structure for what technical content comes into each part of the course. This overall structure appears to work well with this program.

When the written Chapters (extended lecture-notes) were introduced in 2014 instead of a textbook, they were found preferable, to a degree that surprised me; no suggestion was received of them being too long. However, now in 2016 there is a strong view that there is too much text: this is probably encouraged by my having mentioned that I worry about there being too much text, and that another program (Elektro) complains about this. Improvement of the material is thus a major need for the next round, since I think it would help both programs.

There was a worrying time around the third week of the course, when it was clear during the lab session that students were not up to date on the material needed. It seems this was a bad combination of this course, hand-in tasks in the parallel course, and possibly a recent ski trip. This has been discussed in the mellanlänkmöte (halfway link-meeting) with the program, student representatives and other course-responsible, and we will look even more carefully next year at the initial workloads including the activities that don't appear in the schedule.

In the first kontrollskrivning (part-exam) one question was clearly found a lot harder than I had expected. A similar situation arose in the final exam too. This was alarming, as such a large difference between my expectation and actual performance has not happened before; it is something to check carefully next year, possibly asking the other

course-teachers to report what time they took on each question when checking it, and whether they think it unusually hard.

Changes for the next (VT17) round
The main intended changes for 2017, sorted from more to less important, are:

- Literature: make core material more concise, and ensure the later topics feel complete.
  Due to time constraints this will probably require hand-writing "notes" close to the lecture content.
  This gives an opportunity to make [perhaps!] videos based on speech over the process of writing these.

- Tutorials: do "central planning" of the exercises to run: write and publish the questions in advance.
  Include a final question in the style of an exam question, where appropriate (not e.g. topic 1).
  Discuss further with tutorial teachers about notation and about not saying how terribly easy it all is!

- Lectures: plan in more detail (!) – how/whether to get more stimulating quiz questions?
  Consider small redistributions of topics: e.g. reduce three-phase and extend AC introduction?

- Laboratory: consider removing or changing a lab (lab2?) or at least a subject within the labs (opamp?).
  E.g.: Keep Lab1. Remove Lab2. Keep Lab3 [called 2!]. Add lab in AC part, e.g. after filters.
  Simplify all the labs to a single main question with preparation. Provide optional further tasks.
  Also re-check the clarity of the lab descriptions before using them.

Prerequisites
The impression is similar to last year. Maths seems adequate, as the main cause of lost points in the exam was errors in circuit-analysis concepts, not in handling equations. Complex numbers appear to have caused most need of brushing up the maths skills.

_____ **End of the main Course Analysis** _____

Appendices follow, with Course Evaluation comments and discussion.

      Appendix A: summary of responses
      Appendix B: the evaluation form used

Below are some comments reflecting the general view of "not my favourite subject, but made tolerable in this course", and that the course has been improving year to year. Several students from earlier years took the course again this time.

It was a great structured course. Good teachers. Hard topic.
Generally really good course.

Du gjorde ett ämne, som för mig inte är så intressant, roligt.

Jag tycker ämnet i sig inte är superroligt men med en bra, uppstrukturerad kurs och motiverad föreläsare blir det inte så jobbigt / tråkigt och tycker att nivån legat på en bra nivå.

Good work! Makes a big difference when the students feel that the teacher cares and is engaged in the course.

The structure is much better this year. I really like the lectures and övningar.

Appendix A   Sorted selection of responses from the evaluation at end of EI1120 VT16 course-round.

See Appendix B for the questions posed.
Comments here are sorted approximately from "bad, needs change" to the other extreme.
Comments made in Swedish (~50%) are "freely translated" to simplify sharing with other teachers.

Course structure

```
structure good as is
structure good
sequence very good
very good topic-division
very good structure in this course
division in blocks and topics very good: nothing out of place
interesting course, very good structure
one of the most organized courses I've taken at KTH
interesting, very hard, super-structured; good and interesting even if topic hard and boring [in
itself]
a lot of work all the time: due to the good structure, it worked
interesting but hard [conceptually]: very stimulating, clear structure
the KS+KS+TEN method is very good [x2]
good having this chance to complete parts through the KS -- helps encourage early work
```

This is similar to previous years. The strong structure is widely liked, and not seen to be disliked by anyone.
No change of principle needed. Some change in timing could be considered: see later section on Workload.
One could argue that students need to learn to put much of the structure there themselves, and to find the necessary information from varied sources: but this course has a lot of material, and comes in a hectic period, and needs plenty of time for practice, so I consider it best to take away all difficulties except for those of learning the actual subject.

Level of difficulty or interest

```
quite hard course -- easy to get stuck on tasks
a bit hard, but made manageable; challenges on a good level
examination [KS] feels a little hard
stimulating, but a lot to take in a short time; still rather difficult [a repeating student]
great course .. I liked the puzzle-thinking
inspiring for further studies: really got something out of it: awesome course
```

Again, this seems typical of previous years. At least among the students who answer the questionnaire, there is a surprisingly positive attitude to learning a subject that is considered quite heavy and that about 5/6 of the students are not expecting to use beyond this year. I try to encourage alternative ways of viewing the course, for those who don't expect to use circuit-analysis later: e.g. as "puzzle thinking" mentioned in one of the responses above, or as practice of general skills in algebra and checking.
No major change needed. Be careful about double-checking difficulty of exam/KS questions.

Workload: total, including coordination between courses

```
very time-consuming [overall]
good structure and course, but this period was too stressful in total (not enough time for
optimal study)
it's an even work-load, but the parallel course is an uneven workload
this course had even load, but parallel course varied more
the combination of this and the parallel course gave some too-intensive weeks [due to this
course also having "peaks"]
course is demanding, but feels manageable: it's more load than the parallel course
the time before KS1 (about 3rd week) was stressful because of the parallel course whose workload
"exploded"
the time around KS2 was hardest
there was not time to prepare for opamp lab, due to a KS in the parallel course
good to have more time after opamp topic, before KS1
```

```
bad timing with the parallel course for both KS1 and KS2 [some other event?]
talk with other teachers about timing of KS: preferably in different weeks, or at least several
days apart [but they were!? Fri/Tue was closest]
well structured, consistently high load, but AC should have been given more time
good, fast tempo: needed much work all the way through, but it wasn't too much
not at all [no problems of timing]
```

This is a wide range of views. Overall, this period was certainly considered intensive. Distribution of time between the two courses was perhaps a little biased towards this course (but there aren't many responses to judge by), whereas the other course was felt to have more variation in work-load between the weeks.

The period around KS1 and Lab2 was found hard: we also observed poor preparation for Lab2. It is hard to see how better timing could have been made within this course, as we already left two days for study of the material before the lab. The combination of courses is probably the main culprit, so this must be considered for next time. A further option is to reduce the content of the lab.

A similar trouble was expressed around KS2, which had not been so visible to the teachers.

Further caution needed with coordination between courses, including non-timetabled assignments

Workload and rate: within *this* course

```
very hard at the START: more repetition of basics needed
opamp very difficult: needs more time; AC also needs more
understood all in 1st half, got a bit confused in 2nd half
easy at the start, and extremely much harder at the end
last period after KS2 (i.e. AC part) was heavy and harder to understand
last part (AC) felt heavier and harder to understand
not enough time on last part (AC), which feels so new; but good structure
yes, final topic of 3phase made things rather hard: more practice examples would be good
    [?? but there are loads of exercises in this topic!]
last block (AC?) seemed a lot more difficult
it would be fun with more computing [calculating, or computer-use?]
AC part really hard -- maybe more time for that
good to have KS on the AC part
yes: it all went wrong at 3ph (spårade ur) [in spite of efforts to give more time and clarity]
have KS on the AC part as well, if possible
have KS on AC part, as that's the hardest part
```

A KS (part-exam) on the AC part isn't very practical, as it would need to cover only part of the subject or to happen between the end of the teaching period and the final exam.

The start doubtless is hard for some, but the risk from taking more time on it is that there is less for other parts, and less feeling of urgency about starting work (for the students who don't need more time at the start). The prerequisites are supposed to cover the basics: these details appear mainly forgotten, but they just have to get remembered/revised if needed!

The opamp part was found, again, surprisingly hard. This might be helped by shorter notes (I thought the chapter was quite good on this topic, actually), and other choice of exercises and tutorial problems. I suspect lack of time was the main ingredient, since some students at the lab could not do simple calculations that would follow from the early exercises.

The AC part is very widely seen as the hardest, and is squeezed into just 6 lecture+tutorial topics. This is the thing to focus on for next time. The material for earler parts is better prepared as I've taught these parts to another program too.

Answers about the average time taken per week on this course during period 3 were:

```
Estimated time per week on this course: 10h, 10h, 10-15h, 10-20h, 15h, 15h, 15h, <20h, 15-20h, 20h, 20h,
>20h, >20h ["yet still not good KS"], >20h, 30h, 30h, "more than the parallel course", "much
more than the parallel course", "more than the parallel course",  ,
```

This looks quite good if it is representative of the whole group of students. There is the usual spread of +/- 10h around the 20h that we aim for, but only a minority are claiming to have needed more than this.

Abstract versus Applied

```
better keeping it without much application: that would be too hard
doesn't have to be application-related
application-level is good "as it is"
could be good for non-electrical students to have more general content
```

```
application after theory would have been interesting

fun with more applications, maybe in end of chapters

would like more examples with application
```

That's a mixture of views, from a small proportion of the participants, and without a clear conclusion!

I feel that requiring good understanding of applications in examination parts of the course could have bad effects of taking attention from the basics of circuit analysis. However, showing some more examples in exercises (and notes?) gives a chance for students with practical interest to feel more stimulated and to learn some of the relevance of circuit analysis to practice.

For the moment, I'll keep the applications in this supplementary (non-examined) form.

Guest lectures are a way to show some applications of circuit analysis. We previously had two guests, but this year just one of them could come (Lennar Söder). He was asked to include a little technical calculation example relevant to that point in the course and to the subject of the lecture.

```
guest lecture was interesting but not necessary

further guest lectures would take too much time from the core

guest lecture very good

guest lecture really interesting — made me think about the master program

guest lecture was very interesting and inspiring

really liked the guest lecture: it inspired me and motivated me to learn more

very nice -- good to have more of that
```

The responses are considerably more positive than in past years. Perhaps, given the intensity of this period, keeping to just one guest is a good choice. I *had* rather intended to find a guest from industry too … that can be something to try once, and see how it goes.
Have one KTH guest lecturer, similar to this time. Possibly add another from industry, if made strongly relevant to the course.

Lectures

```
want clearer lecture structure where "important things said should be written on board"

lectures good, but too much of apparent importance that is said but not written

perhaps more examples and less "löst prat" (chat) in lectures

sometimes not so structured; I think clickers would be good

not as effective as tutorials, but worthwhile: no clickers please!

lectures good, but writing too small sometimes

speak even louder (lectures)

write bigger (needed in some cases)

very good [but] less scribble [i.e. little extra-details added on board e.g. as afterthoughts]

more examples in lectures would be good; and writing is too small sometimes

good to have more examples

skeptical about clickers [suggestion] -- don't think it gives much

some felt a bit messy "until I understood the concept of the lectures" -- I like them as an
overview

came to get an overview

lectures very good (but chapters too long/difficult)

lectures were good for understanding (I read the chapter before the lecture, so found it easier
to follow)

good lectures

good that lectures don't assume students to have read the material before

really good; it's improved by reading the chapter before

the lectures are helpful for seeing and hearing instead of just reading

really like them

very good

you made a subject that isn't very interesting to me become fun

great lectures, I do not like interaction during lectures

attended all, and they are very good: don't need to change anything
```

It's important to keep in mind the need to **maintain a loud voice (or have microphone) and to leave space for large writing,** all the time: these do easily revert to being quieter and smaller. At least the speed and language are not found to be a problem.
There isn't a clear conclusion about having more-organized quizzes (e.g. using clickers): this was seen positively in one response, but

negatively by two.

Several mention about writing more headings, statements, etc. in full on the baord. This has come up in earlier rounds too. I don't like the time that this feels it's taking … the intention is that the lecture is a way to show the topic's content, and to present a key subset of the topic-content from the chapter file. Perhaps it would be helpful to write up a few more sentences as text. However, I feel the students who want this are the ones trying to take extensive notes in the lectures: this isn't really my intention, and it shows that I've failed to make suitable online notes that capture all the important content of the lecture, or else to inform and convince students that this is the case. All the important details are intended to be in the published chapter: one student, in an electronically uploaded response, said they'd worked from home for most of the course, not needing to come to the lectures. It's the intention that attendence of lectures is not necessary but is used by some for audio-visual stimulation, and as an easy way to get into a new topic. **By making hand-written lecture notes (and perhaps videos from these) and following them closely in lectures, this complaint will perhaps be eased without my having to write a book on the board!**

Again, there are requests for less "scribble" or "chat": although a few might enjoy this (as I would) it does seem to fit most people's natures to have the lecture subject very organized, with nothing added as a quick side-comment, application comment, or explanation of prerequisite knowledge that appears to have been forgotten .. I should try harder to stick to only a carefully prepared core material. Experience says it won't happen entirely, but I can at least move a little more that way, helped by revised notes.

Do more planning of each lecture's content, including what *not* to cover!: this is helped if new notes are to be written in the same structure as each lecure.

Tutorials (övningar)

```
better with even more explanation [of the reasons]

this is where the knowledge sticks

tutorials good

good that they give initial repetition of lecture, then write formulae and calculate

good structure, but writing often unclear

very useful: appreciated

very good tutorials

very clear explanations

very good and informative

very good -- one gets a better view of topics

tutorials super; really good; teacher explained further background
```

Good. This has usually been the way, that tutorials have been seen as very useful for the learning, particularly when students are requested to solve parts of exercises themselves. We had a mid-term assessment questionnaire in which suggestions were made about the need of slower speech and writing in one of the groups: this was followed and was seen as a big improvement by the students.

No change needed in the general style of tutorials. One of two teachers will be changed for 2017, so it's important to have discussion about the somewhat interactive style that has been used previously.

```
would like some large circuits in tutorials

examples with larger circuits would be good

good to try solving at least 1 past exam question, not just simpler ones
```

An interesting point. In 2013/2014 I set which exercises would be done in tutorials. In 2015/2016 I left it to the other teachers to decide that. I now think it could be better that I set the tutorial questions, to ensure their relevance to lectures, homeworks and exams. We can then place a more exam-like question at the end. That said, students are supposed to be studying from the many old exam questions on the website: relevant ones are linked from every topic's exercises.

Organize tutorial questions "centrally": include an exam-like one in each session, where appropriate.

```
tutorials in combination with lectures are very good

like tutorial close to lecture: direct, or day after

would be fine (bara bra) to have tutorial directly after lecture

very helpful being not immediately after a lecture but after ~1day

like having tutorials a day after lectures: time for new subject to sink in
```

It seems there's a mixture of opininons about the optimal timing, but that my preference for having a day of space between lecture and tutorial is towards the majority view.

Keep the principle of tutorials, following ideally 1 day after the respective lecture.

```
not good that the teacher says that everything is super-easy: sometimes it's not, and it's all new to us

tell the tutorial teachers not to tell us how easy it is: makes us feel stupid and insecure, and is not helpful
```

It's important to discuss this with the exercise teachers for next time.

```
better if tutorial problems were put up earlier on the web
good coupling between lecture-tutorial
confusing at first with different notation between tutorials and lecture/notes
tutorials better to have more symbolic work, not so much with numbers
tutorial rooms very small
```

These were some diverse subjects that should be looked into for next time.
Specify questions for tutorials in more detail: then they can be posted in advance, and be mainly symbolic.
Check the two rooms for tutorials can each accommodate at least 2/3 of the class.

Literature: chapters [notes] and exercises

```
chapters hard to understand due to too much text -- impossible to get through
chapters were awful: I didn't have time for them, but you thought/suggested everyone liked them
chapters too much of a wall of text for me, but I know other people liked it
way too much reading
chapters too long and difficult
better with more pictures/diagrams in chapters
sometimes a lot of text, but overall give good information
chapter on 3ph hard to understand: boring, lacked pictures
took a lot of time
make more compact
shorter chapters with less text
chapters: too much flowy text, felt incomplete at AC part
a bit too long to read beforehand [before lecture]
chapters sometimes have too much text for the available time
maybe a summary at the start, with all the formulas
chapters language good and understandable, but a bit much text sometimes
chapters rather long for one not so keen on reading and with limited time, but well
described ... shorten a bit?
chapters have good explanations, but (esp. in AC) would be better with more walkthroughs like
the handmade one you did for mutual inductance
in DC/trans it's good content but long; in AC not enough detail and examples yet still long
(time-consuming)
chapters are good, but last ones on AC "felt undone", harder to understand
read before lectures: worked well, but the lectures were very important too
good content, but often didn't read until long after the event due to the time needed
chapters: great, but maybe more examples
I really liked your book, better than the one we used in previous years [i.e. 2012/2013]
very clear and nice: maybe include some definitions/formulas, with summary at end of chapter
good chapters, interesting information
```

The chapters used to be liked, compared to the book we had before. Now – perhaps helped by my having pointed out that Elektro finds these chapters too long – they seem considered too long and texty by the distinct majority. It can also be that the chapters seemed more compact compared to the previous book, but are now being assessed against a hypothetical optimum!

I agree, anyway. Time-constrained people need to focus on doing calculations, not on comtemplative reading.

Cut down the "chapters/notes". Given the time-constraints, this may have to be done by making hand-written notes.

```
exercises in some cases would be better with more detailed solutions and explanation
didn't do them [!]
exercises: good, except that topic10 didn't have any [only links to old exams]
exercises useful when having got stuck [with HW?]
exercises were helpful
would be nice to have more figures [even in questions?] to check that everythings written right
good how they progress from easy to harder; would like application-based examples in each topic
awesome, but only used in the beginning -- lack of time later on
the links to past exams were useful
```

```
good that the exercises files link to past exam questions

good, [but] not much time doing them

love the exercises: good topics that have been helpful, interesting and fun

exercises super: good that they're designed to be easy at the start
```

Some solutions are indeed very terse. Sometimes this was due to lack of time, and sometimes it was all that seemed necessary. But it's worth checking all through to ensure answers are clear at least about the direction to go in the solution.

Exercises of later topics (especially AC) aren't so carefully coordinated to provide a progression from simple use of the new concepts through to more complicated situations.

Some revision of all topics' exercises should be made, to ensure good sequence and to ensure solutions have a bit of explanation.

Several thought the exercises didn't progress to the right level:

```
exercises: preferably more that are like the exam/KS questions

seem rather irrelevant compared to exam-questions -- better with more coupling

more KS-like questions .. felt like slap in face trying to do KS after the exercises
```

It was not intended that *any* of the questions in the exercises must be typical of the exam questions. Each topic's exercise file contained links to multiple questions and solutions from past exam: these were expected to be tried, or at least viewed, after doing the exercises. Possible changes are to arrange the links in a different place, change the text to **be clearer about needing to follow the links to past exam questions**, or even to copy some past exam questions into the back of each exercise file.

There was a question about whether it would be better to have exercises distributed through the main materials (chapter text). This would fit a study-model where the student reads a page or so of description and perhaps a worked example, then immediately gets a chance to practice the new material in a simple way. That's how it could be done now, but with a bit more effort to have two files open, and (more importantly) to identify which parts of the chapters and exercises go together.

```
would like combined with exercises

including exercises with chapters would be even better

good to combine chapters with exercises

good with more examples [in chapters]

great to include the exercises within the chapters
```

There was nothing against this idea. If shorter hand-written notes will replace the chapters, some exercises could nevertheless be included e.g. as computer-written pages interleaved with the notes in a single file. We'll see.

Subject to available time, **integrate further worked examples and some exercises** in the file of chapter/notes.

Laboratory sessions

```
labs: not a benefit as hadn't quite understood the theory by the time of the labs

labs ... hmmm ... hard to understand: I was confused by all the wires

not very useful .. I realised I didn't know much about how to connect simple circuits

should be optional: I get stressed then don't benefit from them

don't think I got much from the labs, but probably good to do something practical

labs "fun" but not sure if helpful

labs "should maybe be more simple"

lab 2 was hard to understand ... put later?

labs: hard to understand what one should do, but good to get some practical work

labs didn't help so much for course material [unless trying hard and asking the assistants] but
showed practical stuff

labs good for "reality", well coupled to course, keep same labs and still obligatory

labs good that they gave an insight of "how it looks in practice"

labs: gave a better view of the course-part, but anyway hard to understand

interesting labs, but it felt that we needed more background knowledge

a bit hard to make connection between theory and applications

nice to practice the theoretical learning

good, helps understanding, 2 is enough ...

really liked labs, and got a feel for the practical work

labs good -- gave understanding

labs really good for grasping the different concepts

great: I learned a lot
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Last year was the first time with labs. Again, the feeling is that most in CENMI aren't very keen on this: it's few who see it as having been definitely useful. Lack of preparation time is mentioned: lab 2 (opamp) had been placed as late as possible after the relevant

lecture+tutorial, but there was still poor awareness of the topic's basics during the lab. I suspect this is a major part of why it was perceived as not very useful [for learning]: we assumed that students would have done the respective set of exercises in the days just before the lab. Course-coordination seems relevant here, as I was told there was a heavy load in the other at this time. But we don't really have *any* time in this intensive course when we can afford to have 2 days being given fully to the parallel course. The suggestion of "2 labs is enough" is interesting: perhaps we can drop the middle one about opamps, which is less intuitive as it involves a component within a complex-looking board. Alternatively, we could drop the apparently awkward opamps topic from the labs, and have a lab during the AC part of the course instead of all three in the earlier part of the course. A preparation task is probably advisable in each case, to avoid wasted time at the start. Such tasks were avoided before, as we don't want to make the labs feel like a big user of time, and experience also suggests that some student don't do preparations anyway. That latter point could be mitigated by an online test (in the style that the Elektro 3rd-year course Mätteknik has successfully used).
Consider cutting/changing one lab. Include clearly defined preparation task to show what one should be capable of doing even at the start of the lab session.

Homeworks

```
good concept -- but way too many

homeworks very useful to learn through, but took a lot of time (didn't do many exercises)

hadn't enought time for exercises: homeworks became priority

helpful for keeping up, but time-consuming and therefore reduce time on exercises

homeworks great, helped a lot; can be good to have more mandatory ones for AC (i.e. "do half of
them" results in just DC/trans)

a bit short time for some -- coordinate with other course

a bit tedious when there was lots of other work, but useful for keeping up

good that not all HW had to be done

homeworks very good: some obligatory part is useful, but it's nice that it's not a hard demand
of all 12

homeworks force keeping up, but sometimes too hard, so "everyone cheats from XX" [initials
supplied, matching a high-scoring student]

homeworks good: sometimes hard to do these as well as exercises, but I like that we have the
homeworks

good: gave better understanding of topic; nice that it was just Pass/Fail, to avoid adding to
the stress

homeworks should give more bonus-points

homeworks good for keeping up

homeworks good -- necessary!

homeworks helped a lot

homeworks good and marking good

a great way to make sure I was in phase

homeworks GOOD -- a lot of work but good for learning
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Have a mandatory minimum number of homeworks from each section of the course? Perhaps sensible.
Or make them be marked online, and thereby make it easier to require 100% response as well as saving teachers' time in the long term -- must look in to this possibility with the new KTH system that replaces Bilda, or with our local Moodle system.
More bonus-points? Possibly, but a reason for it being so low is related to the comment about "everyone cheats from ..". It's intended that the advantage in the exam from actually having done the homework is greater than the advantage from having obtained the bonus-points.
More coordination between the courses? Seems hardly possible if we keep the principle of doing 12 in 7 weeks, and of each being finished before the following lecture, as we want to be able to build on the previous subject.
No firm conclusion! Keep a quite similar level of bonus-points. Not sure whether to have a mandatory number in each part of the course, or just not have it mandatory at all. Slightly lower demands, to give more time for exercises? **Web-based submission and automatic marking would be wonderful, but with initial time-cost.**

Miscellaneous

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I didn't find such good videos (youtube) for the ac as for dc
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Interesting in several ways!
It's surprising if there aren't plenty of online videos about ac circuit analysis.
And this is a reminder that several students each time mention the use of videos as extra material ... is it worth making our own too, to match well with the course structure and material? I find videos inefficient for most learning purposes [for myself] compared to written materials where the eyes alone can pause/rewind/etc .. but a significant number of students express their perception that

videos were highly stimulating and useful for them.
Consider (again!) producing videos, e.g. of handwritten lecture-notes being written …?

Comments about whether the student would be willing to answer the KTH LEQ as well as this questionnaire.

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LEQ: it is important to use this, for the sake of comparison and easy summary

LEQ: "do what method you want (for best course-development) as long as EVERYONE gets a chance to
answer [i.e. not just who's present at lecture?]

LEQ: "I prefer this sort" [i.e. not KTH LEQ]
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I didn't get round to using the KTH LEQ: I was swamped with other things as soon as the exam was finished.

Students were invited (via course announcement on KTH Social) to fill and submit the same evaluation questionnaire by anonymous upload if they hadn't attended the lecture: two did this.

We had about 45% response, considering the total number taking the course. That's as good as or better than what I've managed by LEQ in another program (25—30%). It's about what we used to get when SNO did the course-evaluation.

For next year I'd consider using the KTH LEQ. I don't really like to saturate the students with multiple sets of questions.

The evaluation form given out 2016-03-11
The same form with a modified header (including upload link) was also available for filling online.

EI1120 (Elkrets CENMI) VT 2016 kursutvädering

I am still interested to make changes... even more than last year, because of new experiences teaching another program (Elektro).
The general structure that we've evolved over 4 years seems to work with CENMI, but I feel Chapters and Exercises can be improved by revising the text,
   adding exercises, and *mixing* the two. It's also interesting to make more compact notes for Elektro årskurs 1, who don't like lots of text.
Other likely areas for change are how the homeworks are incentivised, and what preparation is done for the labs.
We can even consider changes in what's expected in lectures: more preparation expected?

You! General perception of the course.   Boring/hard/inaccessible, but something to get through. Or interesting in some electrical way.
Or stimulating just in terms of the intellectual challenge, practising various skills, etc. **If you're repeating,** please mention this and compare this round to
when you first took the course.

Course "flavour": e.g. Theory versus Application.   Would it inspire you to think/learn more in this subject if many questions were
application-related? Did the first lecture and guest lecture manage to convey some of the relevance?

You .. time-load. How many hours have you put in? Being a 7.5p course in 1 period, 20h/week is the supposed workload: wholly unrealistic? Any
problems with how it fits together with KE1060? Just too hard for the available time .. or quite comfortable...? Effect of ski-trip…

Topic division: logical structure, and timing. Concepts that felt in the wrong sequence? Any particularly stressed periods – very
heavy or light topics?

Lectures.   How much attendance? Good/Bad aspects regarding what you feel became clear or inspired you to study the subject (chapter/exercises)
afterwards? Why do you come – helpful to see+hear instead of just reading; interesting further details not in notes..   Were attempts at interaction any
use? Might "clickers" (devices for secretly voting your answer) for a few quizzes be an improvement (encourage you to think, discuss, wake up)? Is it at
all realistic to expect students to have read the relevant chapter before a lecture?

Tutorials. How much attendance? Good/Bad aspects regarding what you feel became clear by attending. Good that you were encouraged to do some
of the work? Were the exercises well chosen to be helpful to you? **Would you prefer** these directly after, or a day or so after, the lecture?

Chapters.
General feelings … too much text, not enough explanation, more pictures needed? **Better if mixed** (or even completely combined) with the exercises, so that instead of all the theory followed by all the self-study, they are interleaved. **Any particular** Chapters feeling insufficient, or thorough and useful (good to know for making updates)?

Exercises.
Generally ok in working easy-to-harder? Particular topics with too little or badly designed? Helpful to link to old exam questions? Good to have more practical applications in all topics' exercises … it means more text, but makes it perhaps more interesting? See 3phase (13) for some application examples.

Homeworks.
Did they serve the purpose of helping you keep up-to-date? Silly marking (basically, have to be very bad in order not to be approved!). Better with e.g. several possible grade-levels, with just bonus points as the incentive, based on sum of all HW grades?

Labs.
Any use at all?! Better with a moderate preparation task? Need more guidance/diagrams? Did they appear to connect to the rest of the course? Any suggestions for next time: clarify or simplify the tasks; add more labs, remove some, make all optional, …

"3~" (three-phase):
Did the hand-written notes seem obviously better or worse than the "chapter"? I've tried to make this subject more accessible each year, but it's so far always been the thing that kills the course: "... *men den spårade ur när den kom till trefas*".

General stuff.
Course would be improved by a totally different structure … what? Course should be more based on simulations and computers? Assessment structure: improvements on KS,KS,TEN system?

KTH LEQ:
After already spending time on this paper, would you be willing to answer the standard web-based "LEQ"? I haven't used it in this course: I want to reach as many people as I can, and it's given me low response rates in other courses. I also think that "choose 1 to 5" questions are usually not very helpful compared to free text, at understanding what's actually being said! But my colleagues and your program might like it.

Yes / No

Further space....