Course Analysis
EI1120 Elkretsanalys för Energi och Miljö (CENMI program) 7.5p
VT20 P3 (2020-01-15 – 2020-03-10)
Nathaniel Taylor

Staffing

Responsible department: Electromagnetic Engineering (KTH/EECS/EME)
Course-responsible, Lecturer, Examiner: Nathaniel Taylor (writing this analysis)
Examiner (formally): Daniel Månsson
Other teachers (övning, medrättande): Md Tanbhir Hoq, Md Zakaria Habib

Events

Lectures: 15 double-period sessions (i.e. 22.5h), usually two per week.
Tutorial (övning): 14 double-period sessions (21h), usually 1 day after corresponding lecture.
Laboratory tasks: 2 lab sessions (obligatory), each taking ~2 hours, each organized in 4 sessions of up to 10 pairs.
Homeworks: 10 homeworks, submitted by email or paper; obligatory to pass 5, exam bonus from doing more.
Lectures and tutorials were generally well attended, by more than half of the class.

Registered students

95 students participated at some point during the course (KS1, KS2, exams, homework, lab); 5 of them were on exchange. This is around 10% or 15% more than in several recent years, but 20% less than in the exceptional 2019.

Results

The same principle was used as in recent years: a final exam and two partway exams (KS) that can contribute to it.
Exam, 2020-03-10: 81 students, 89% pass after Fx completion: A (10), B (14), C (19), D (17), E (12), F (9)
Re-exam, 2020-06-05: 12 students: C (1), D (4), E (3), F (4).
As usual, most students were newly registered to the course, and passed either all or none of PRO1/PRO2/TEN1; 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 consist of the final exam (TEN1, 5.0p) and two other ‘moments’ (PRO1, 1.5p; PRO2 1.0 p). This year, as in several previous years, PRO1 is passed by the minimum number (5) of homeworks being approved, and PRO2 is passed by attending both labs. The final course grade (A-F) is the same as the exam grade, when all three moments are approved.

Prerequisites

Adequate. See earlier analyses, e.g. 2018: the impression is very consistent. The course really doesn’t require more than maths as a prerequisite. Some students struggle at first with the specific types of algebraic step and then with complex numbers, but they get familiarized. Problems with grades usually don’t show signs of stemming from just a lack of the prerequisites.

Course material

This was unchanged, apart from some variation of which alternative homework tasks were chosen. All the material is available online on the course webpage; see earlier analyses for more detail.

Comment on load and timing

[This is related to the first point in the next section.]
Each year I feel that the timing would be far nicer if there were one more week, or if we cut one or two topics (opamps, frequency-response) that aren’t strongly in the electric-power direction. But one reason for liking to keep these topics is that they have a generality that makes them relevant even for the students who go in other directions than electric power: e.g. instrumentation, and modelling of chemical and mechanical systems. I have also not wanted to risk making early weeks any more intense: it’s important to have a strong foundation for the later weeks, so a rush at an earlier stage could have a big knock-on effect, whereas an intense final week or two can be made up somewhat in the study week that follows.

Changes proposed in the 2019 analysis

Intensity of the second-last week. Some of the intensity reported by students last year is a result of this and the parallel course having peaks of load in the same week. In the 2020 schedule, the second-last week of study (17/Feb-) was kept to 2 topics rather than trying to pile part of a third topic into it.

Be clearer in the project task about load-modelling assumptions. This wasted time for students last year, and was only cleared up after questions in the help-session a few days into the work. The information was there, but wasn't picked up among other information. This time the wording was changed, and big red letters were used too, to try to avoid that students would attempt exact solutions rather than the advised approximation. Warnings and more explanation were also given at the project-introduction session.

Homework deadlines and load. This has been an issue for several years. There is no obvious 'solution', as there are always opposing views. Some students are happy to have a task per topic and short deadlines, in order to fulfil the aim of being forced to clear up one topic before moving to the next. Some instead want longer deadlines and/or less load. Only half of the homeworks are even mandatory, although the remainder give some bonus. This year we reduced the number a bit (10 instead of 12) with the removals based on less-essential topics. Following the approach tried last year, the one or two tasks within each week had their deadlines into the start of the next week.

Neater short-version lecture-notes. Last year this was listed as 'less high priority', and it was noted that no comments were made about any trouble with the notes; there were indeed positive comments, although my own view was that it would be very good to improve the neatness of handwritten notes if I had time … no change was made - as anticipated! However, this year there were a few comments (see below), about a worse quality of material in the last part of the course, and about messy writing. This helps reinforce the desire for improvement.

Online tests. This was also a 'less high priority' that would be nice given lots of time. As anticipated - again - it was not done. Now, thanks to the likely need to have online exams, there might be more attention to this.

Evaluation

The CENMI program held a link-meeting on 2020-01-29. This was only about 2 weeks into the course, and the second week included the ski-trip, so there wasn't long experience of the course at that point: the meeting was a chance to catch any major troubles and make simple feedback about tutorials or lectures. One point was to make tutorials slower and calmer, even if that meant getting through fewer examples; this has been heard before, but it commonly happens that the preferred level is reached only after hearing the point from students' feedback rather than as a hint in advance.

The final evaluation was done by distributing paper in a lecture (2020-03-02) and providing a web-form (2020-04-09 - 2020-04-20, advertised in Canvas and by email, after results were returned to students).

This time it was fully unstructured. The instructions for the web form were simply: *"I textrutan nedan kan du lämna kommentarer till slututvärderingen. Alla tankar och förslag välkomnas (vi vet redan att 'snabbare rättning av tentan' vore bra...). Negativa kan vara lika användbara som positiva. Bara ett fåtal ord kan räcka för att visa åsikterna i många fall: det måste inte ta en lång tid."*

There were 30 responses on the web, and 3 on paper; most pens were seen to be put down in the lecture when it was mentioned that there would be a web alternative. This ~40% response rate is typical of earlier years that didn't use an LEQ: contrast with the exception in 2019.

It is interesting that, compared to last year's evaluation, there were more points that really appealed as "this is something we should work on". I have a suspicion that the unstructured format can be helpful for this, as long as it is felt that there's a chance that views will be listened to.

Summary of Evaluation Responses

The overall view is 'very satisfied'. A few (3) had a definite negative view, i.e. strongly-put points without any positive view expressed: in some earlier years this didn't happen, which led me to wonder whether the silent 50+% of the students had similar or opposite views to the responding ones. Some others included a mix of good points and points for improvement. The negative points are appreciated, and often useful. The majority of them either fit well with comments from some other responses, or make clear what changes should be made; but a few were hard to conclude anything from. Some matters get very different opinions: one response included the line *"Great, eloquent lectures combined with well-linked and pedagogical tutorials"*, and another response consisted solely of the line *"mumbling in lectures and unclear structure of tutorials"*; however, another response also noted that speech in lectures or tutorials wasn't always easy to follow, so the above quotation helps reinforce a desire for louder and perhaps slower speech.

Paraphrased/translated points, each from one or more respondents, are listed below in italics. Comments on these are given below them in small text.

General points

liked the planning and structure, and flexibility
website is good: all you need, in one place
focused course-material is good compared to picking parts out of a big textbook
good structure
helpful and prompt answers to those who ask, e.g. by email or after a class
gold star for always answering mails well
recommendation to later students: do all the optional parts, KS & HW
Similar comments have been seen in past years. It is good to get them, for reassurance that some parts of the core are still seen as being in the right direction.

I'd have liked to be forced to realise one has to know the basics before starting to study this course
Does this mean prerequisites - which I think are not needed except for maths - or does it indicate an attempt at quickly attempting homeworks etc before having done the ground-work? In discussions about homework tasks, it has shocked me that anyone is starting them straight after a new topic starts (it seems many are doing that), rather than after reading more, building up with exercises, etc. This could be something to emphasise about the general flow, even if we remove homework tasks.

would like help-sessions, e.g. 2 during the course
At least two such views were given. In some previous years this has been done on request during the course. It will be offered next year.

coordination with the other course is still a trouble - e.g. with two KS and 4 tasks in a week
This is clearly not about the second-last week that was reported as a problem last year, but an earlier week, probably the one with KS2. The idea of dropping homework tasks for 2021 should help this, along with the usual level of coordination.

notes made afterwards were sloppily done
Is this the handwritten notes, used as the default instead of the computer-written notes since 2016? I agree that, at least for the later topics, these should be neatened. The older computer-written notes are a neat alternative, with more text than suits some tastes.

lab1 was good and fun; but lab2 had not enough working equipment for our group... get more or newer
Alternative: fewer groups per session - which might be forced by restrictions next year anyway.

Practice questions, and solutions in general

practice-questions are very pedagogic and clear

The above has often been stated. However, the following ...

exercises for every topic should start with very easy ones

... is one of two comments that say that a few later topics have inadequate exercises. One response cites the frequency-response topic as an example where, instead of questions building up from smaller parts, just past-exam questions are provided. The response makes the good point that someone who has not yet understood just a little part of the topic background could get stuck at that point (a group of several people spending more than a day was mentioned). This is taken onboard as a very valid point: whether or not that particular topic is kept in the course, we should check that all later topics still have a few getting-started questions beyond the examples in lecture notes.

The strongest comment about trouble with provided solutions is:

one of the hardest courses because of lack of support and examples

This went on to give an example of another course, MJ1112, whose KS solutions should be taken as a good example of a solution. Over several years we've found that the format of many of our exam solutions has caused few or no queries from students in later years, whereas attempts at being more concise have resulted in more questions. This respondent might have been looking at one of my attempts at being concise. I will anyway look further at the suggested solutions for ideas. Update: I have obtained some model answers from that course, and agree that they're good and clear. However, I don't feel that some of the circuit solutions can be so easily serialised into lines of equation, particularly when the intention is not just to show what would have been a good exam answer, but also to explain what alternatives there were for the solution. Circuit solutions can often be

done in many ways, and can be heavy on the need for diagrams, which makes it demanding to typeset really 'nice' solutions for a whole exam within a reasonable time. Anyway: I'll bear it in mind to try some variation of the style.

Lecture structure.

Summarized from several comments:

'messy' board-work; use more headings; start with list of the day's content to tick off from; keep to first-in-first-out; rotate around the boards

It should be noted that there were plenty of other comments saying 'all good'. However, the above makes sense when I think back. Around 2016 I managed to avoid all such comments by working hard on this 'systematic person' style where everything is very calm and planned, and no last-minute interesting-to-me extra details are inserted. This year I have very likely drifted back to the slightly more scattered 'performance-style' that I would find more stimulating to watch, and that a few student responses suggested that they liked too. If next year has anything like lectures (!) I will try to avoid any such comments by working on this again.I can definitely understand why the comment was made, although I suspect that there are some people who like the style of using a board just for the diagrams and equations.

be sure to introduce a new idea properly before starting an example

This may indicate that I've tried too hard to provide examples early rather than 'waffling abstractly' about a new concept. I'll work on more balance.

thank you for never making the lectures go late even by a minute

My memory suggests this comment might be a little kind: but probably I kept it just below 60 s in the worst cases. Thank you!

lectures good and content-rich but perhaps the last few rather more stressed and hard to follow

This couples to the discussion of dropping a topic or two, in view of the regular problem of fitting the last part of the course into the time, along with the parallel course. I believe it's also affected by how my other workload tends to build up at that time of the year.

detailed working-through of KVL/KCL in first lecture

I remember leaving this to be read in the notes, on the grounds that it's from school too. But yes, I agree, it's essential, so it should be presented too. Missing it was not intended from the start, but was bad time-planning after the subject introduction, which I'll try to do better next time.

good to have more about the coupling of the course to the program

An interesting point, never raised before that I remember, nor really thought about hard by me. I try to couple the course to the world, sustainable energy, and big changes going on in those subjects today - but not to what else goes on at KTH before the MSc program. I could at least point out what courses it requires, and what ones might benefit from it.

more about "what is electricity" in the first lecture

Again, a not-seen-before comment. I did more about this when I had the CELTE program, believing that students who have chosen electrical engineering would feel more interest in this sort of question, whereas I'd seen that the majority in CENMI appeared to thrive more on the abstract and mathematical approach. This matter of how abstract to have the course was taken up in an analysis a few years ago. But I will bear in mind to take a few minutes on that subject at the start. There were some handwritten slides on the course webpage about this, and the CENMI program has has a Fields and Waves course before this course.

Tutorials (övningar)

good pedagogical tutorials, from both assistants
good help in the tutorials
tutorials 'badly planned', not coordinated between teachers (different tutorial teachers, or lecture-tutorial?) too much
should be more structured
show more clearly which exercise number an answer is about
don't think I've ever had such helpful assistants
very 'engaged', helpful
still too many tasks in an övning

Views from both sides. Probably, as with lectures, it would be overall positive to work towards even more 'structure' in what's written and said, and also to aim for "as slow as feels reasonable, and then a bit slower" in order to meet what students feel best for them.

a lot of background noise too, so not possible to follow if it's not on the board

An important point to note: we must ask the group to be quiet when the leader is working on the board.

Homeworks

homeworks an unnecessary extra stress
heavy work-load from hw

This is a regular problem that's come up in previous years. By no means all agree, but next year we'll try being different: see the 2021 plans.

too much text in tasks/hw; not a problem being in English, but too long

Too much text is mainly why I started the hand-written notes instead of the earlier pdfs (chapters). At that time, CENMI students seemed so used to reading long books about Energy and Environment subjects that they had no trouble reading shorter chunks of text in this course. Later views have tended more to not liking big chunks of text. I will look at the project description again, to see if I can improve it. Even just a restructuring can make such a thing more readable.

Project

felt connected to reality - interesting
fun and educational - a time-efficient way to work with the 3-phase topic
interesting to get stuck in to a real problem
Good! Pleasing that there weren't negative views on the principle of having this quite applied subject at the end.

For the next (VT2021) round

A repeating pattern of concern about too much homework and too stressed final part of course makes it tempting to try some changes, to see what happens. This was helped by the evaluation comment that "homeworks felt just an unnecessary extra stress" (my translation). It's interesting how positively a higher homework load was received in the year when I introduced it!

1. Definitely: try having no homework tasks. Students can then choose their own tasks from the exercises and past exams. The PRO1 part of the course would be passed automatically with passing the exam, unless some larger change happens due to forced changes to the course (e.g. public-health related).

2. Tempting: remove at least one topic (e.g. frequency-response), treating its subject much more lightly, within the confines of the existing course-plan, which is not very specific about the level of the less essential topics. Thus, spread the time better near the end of the course. This is a response to the very clear view that students perceived the final few topics and weeks as more stressed and unclear.

3. Coordination with the parallel course is important, but the underlying problem (overload) would probably be more helped by the two points above than by any amount of coordination of the current set of tasks. Nevertheless, pay attention to schedule and communication in the autumn.

4. Book a couple of 'help-sesssions': we can wait to see what is happening in VT2021, then consider adding these.

5. General points of working to get back to very structured lectures, and including in the introductory lecture a bit about 'what is electricity' and connections to the program.

6. In our time ('covid-19') a major concern for VT2021 is about what restrictions there might be on group size, examination form, labs, etc. Labs have been tight-packed, so would not be able to happen in that form: probably they would be cancelled, and replaced by modified versions perhaps using simulation. The course material is all online anyway, and is has been stated in every year that students should be able to get through the course without attending anything other than labs and an exam - the other events were for those who find them stimulating and useful. Lectures could easily be changed to online live format. Tutorials would probably be a bit more awkward for handling questions, but would work. There should be some well-monitored form of assessment of students' individual abilities to do circuit analysis: for example, some remote oral-exam component even if the rest of the examination is done in non-invigilated web-based due to the new pressure for that format. I much prefer the inviligated writing method for reliable checking of individual work, as I worry that oral exams put unreasonable pressure on some students who are capable but do not like being under such immediate pressure. Thus, the biggest worry I anticipate would be about the reliability of assessment.

The usual scheduling request has been made anyway for VT2021, and we will decide near the time, with better information, about how to modify the course to fit the situation.

Thoughts for the future

Previous analyses have discussed radical change in the course. For example, trying to be more applied throughout. One constraint was that the course is supposed to provide all the Circuits background that's considered necessary for studying the Electric Power Master program, even though only some 10% or so of the students take that direction.

The 2020 Annual Meeting of the Energy and Environment program (CENMI), in June, included an interesting presentation of ideas developed by the student representatives. Part of this would be to drop this type of mandatory but very specific course, and have a version for just the students who choose a particular direction. That could leave the possibility of a shorter course aimed more at application examples and intuitive understanding (conceptual questions, estimation, etc) rather than the focus on applying rules and algebra in a very 'dry' way. In some ways that is tempting, as I think it would make the subject more memorable and relevant for the majority of students who won't continue with electric power. However, on the other hand, it would lose some practice at the general competence of systematic analysis and extensive use of algebra in physical problems. All of this presented idea is just a suggestion, likely to be modified in various ways if it is implemented. As with the possible public-health concerns of VT2021, we will wait for more information near the time before making any further choice!