COURSE ANALYSIS

An asterix (*) denotes non-compulsory data.

Course data

Course name	**Design of Electrical Machines**
Course ID	EJ2222
Credits	7.5
Time period for course	**Study period 1, autumn 2016**
Teachers	Oskar Wallmark
Classroom hours	32 hours (major part of work carried out outside the classroom hours)
Nr of registered students	11 (=number of students following the course)
Examination rate, in %	TBD (deadline for hand-in assignments has not yet passed)

Goals

Global course goals	After completion of the course the student shall be able to: • Apply the theory of MMF-waves to estimate air-gap flux densities, magnetic flux, inductances, and to derive the steady-state equivalent circuit of the induction machine (IM) • Apply the theory of MMF-waves to analy ze and understand limits of permanent-magnet synchronous machines (PMSMs) • Implement a finite-element (FEM) based solver in a Matlab environment to solve static and quasi static, two-dimensional magnetic problems • Use FEM-based computations to estimate different performance parameters of IMs and PMSMs • Estimate stator and rotor resistances, magnetizing inductances and leakage-inductance components for IMs and corresponding parameters for PMSMs using analytical and numerical methods • Carry out a preliminary electromagnetic sizing of an IM given a defined torque request and thermal limitations • Carry out FEM-based computations on PMSMs to extract data to implement transient PMSM models including magnetic saturation, magnetic cross saturation and the impact of harmonics • Carry out FEM-based computations to estimate the resulting temperature distribution in an electric machine of IM or PMSM type
How the course design helps fulfill these goals	The concepts are presented during the lectures and are worked with by the students in the project work.

Pedagogical development - I

Changes made since previous time course was given	The course compendium used last year was revised substantially.

Course evaluation; comments from students

Based on the questionnaire used at the Division.
If the course has less than 10 students, the questionnaire can be replaced by informal discussions.

Evaluation response rate*	7/11 students.

Overall student view*	• 6 students (85% of the respondents) gave the course an overall grade of 4/5. The remaining 1 student gave the course an overall grade of 5/5
	• Final comments regarding the course:
	  ○ I will make use of the compendium in the future! Thank you for this amazing work.
	  ○ Good course
	  ○ I really like electrical machines and hope to do more things on it.Everything is pleasant.Maybe it will become more interesting without strict deadlines☺

Positive comments	• What was best with the course?:
	  ○ The way it approached the design (e.g. derivation of the different inductances based on the mmf instead of taking a transformer and modifying it) : it was thoughtprovoking many times.
	  ○ Getting to know the FEMM software; Understanding machines from the very basics. Furthermore, the professor was very motivated to help when students had problems with the project.
	  ○ Understand how to work this kind of induction machine with analytical explanations
	  ○ I have learned the basic things when designing an AC machine

Negative comments	• What was worst with the course?:
	  ○ The amount of work combined with the lack of time.
	  ○ See the criticism about the later lectures above.
	  ○ Simulation with FEMM took so long sometimes !
	  ○ Some assignments are really tough(or maybe just for me☹)

Pre-knowledge, comments*	• Additional comments regarding background knowledge:
	  ○ This was the first time that I came across FEM and the theoretical part (chapter 5 in the course book) was very dense for me. I think knowledge from previous studies should have helped. On the other hand, we could choose not to do Project 5 where one has to go into details in theory to implement it effectively.
	  ○ The only course content being new for me was the part about the FEMM simulation
	  ○ Lack of corresponding knowledge of software

Course design, comments*	

Literature, comments	• Additional comments regarding the course book
	  ○ I liked the book.
	  ○ VERY GOOD compendium!

Examination, comments	• Additional comments regarding the examination
	  ○ I'm still lagging with three assignments, but generally I think that by doing these assignments one can learn and understand a lot.
	  ○ Assignment 2 was just copying the 'recipe' from the compendium and did not really contribute to a deeper knowledge. This task should be a bit more demanding.

Particularly interesting* comments	• Some interesting comments are highlighted above.

Course teacher's impressions from the evaluation

Comments	I am happy with the constructive feedback I have received.

Course teacher's summary

Overall view	• I am relatively happy with the course outcome
Positive comments	• See above
Negative comments	• See above
View on pre-knowledge*	• See above
View on course design*	• This course design enables participants both from PhD students from other universities (following the course EJ3222) and nearby industry which both are very important types of participants for the EES school.
View on course material	
View on examination	• This type of examination works generally well with PhD and late year students.

Pedagogical development - II

Outcome of course changes made since last time course was given	• Two students took the project on hysteresis modeling which was added compared to last year.
Changes to be made before next time course is given	•Fixing smaller errors in the existing projects and course literature and adding an additional project on transient modelling of permanent-magnet drives.

Other

Comments*