IF1613 Electromagnetism and Waves 7.5 credits

Elektromagnetism och vågrörelselära

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for IF1613 valid from Spring 2011

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Physics, Technology

Specific prerequisites

Completed upper secondary education including documented proficiency in Swedish corresponding to Swedish B and English corresponding to English A. For students who received/will receive their final school grades after 31 December 2009, there is an additional entry requirement for mathematics as follows: documented proficiency in mathematics corresponding to Mathematics A. And the specific requirements of mathematics, physics and chemistry corresponding to Mathematics D, Physics B and Chemistry A.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The course has two principal goals: To provide knowledge and understanding of basic electromagnetism, and to obtain dexterousness in engineering problem-solving.

Electromagnetism: The history of electromagnetism spans several centuries. Therefore, its terms are a product of history and are not always very logical. After the course, you shall be familiar with the fundamental terms and know the definition of the most common of them. The goal is that you shall be able to speak to electrical engineers as a peer. Electrodynamics can, mathematically speaking, be condensed into Maxwell's equations. You shall learn these and shall be able to use them to solve electromagnetic problems (see below). In order to harness electromagnetism to solve real-life problems, various components and systems relying on electromagnetic phenomena have been developed. You shall know basic components and phenomena to be able to suggest and explain how various problems can be solved by the means of them. You will become acquainted with optical components and optical measurements through the two sessions of laboratory work. Having completed these, you shall know how to plan and perform a systematic test of a hypothesis and you shall also know how to write a corresponding report in a professional manner.

Problem solving: After having completed the course you shall be able to translate problems of electromagnetic origin into a mathematical form so that a qualitative or quantitative solution can be obtained. You will frequently find that mathematical models have complicated solutions (or they may lack solution in a closed form). Therefore, one often has to resort to approximations. After completing the course you shall be able to actively use different physical or mathematical approximations and also be able to judge whether or not they are relevant, i.e., if the so-obtained solution is valid. Sometimes not all needed data for the solution of a problem are available. Conversely, one sometimes has irrelevant or redundant data. After completing the course you shall be able to present and give solid argumentation for your solution. This means that you shall be able to motivate whatever assumptions or formulas you have used, and be able to explain why any data you chose to discard is of little or no importance for your solution. Finally, you will find that it is human to err. Simple mistakes and misunderstanding are two common sources. With the help of dimensional analysis of the solution one can detect most, and correct many, errors. After completing the course you shall have adopted the habit of always checking the dimension and magnitude of the result of your calculations to prevent presenting erroneous solutions.

Course contents

- Electrostatics: Field strength and electrical potential, Gauss' law, metals and dielectrics, the capacitor, electrostatic energy.
- Magnetism: Origin, magnetic forces, magnetic materials, coils, magnetic energy.
- Technical applications, magnetic induction.
- Maxwell's equations.
- Fundamental notions of waves.

- Electromagnetic waves: Generation, polarization, interference and diffraction, technical applications.

Course literature

"Elektromagnetism" av Lars Alfred Engström, Studentlitteratur, ISBN 91-44-01510

Laborationsinstruktioner som kan laddas ner från kursens hemsida.

Undervisningsspråk: Svenska

Examination

- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Written, problem-based exam. The grading will be based on the exam score. Points earned by handing in a voluntary home-exam or passing student-lead problem-solving classroom exercises will be added to the result of the written exam before grading. These points will expire within the year the home-exam/student-lead problem-solving classroom exercises were handed in/completed. To pass the course, two sessions of laboratory work need to be approved. These will only be offered during the period the course is scheduled.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.