EI1220 Electromagnetic Theory E 10.5 credits

Teoretisk elektroteknik E

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

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

Establishment

Course syllabus for EI1220 valid from Spring 2019

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Corresponding to the courses for the master of science program in Electrical Engineering in

- Linear algebra
- Differential and integral calculus, in one and several variables
- Electrical circuit analysis
- Vector analysis

Language of instruction

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

Intended learning outcomes

General goals

After the course the student shall from a description of a situation that leads to an electromagnetic field problems be able to

- use their conceptual understanding of the electromagnetic laws in order to qualitatively describe the behavior of the solution to the problem
- use their ability to manage the electromagnetic laws to, in simple situations, set up a computational model and perform the necessary calculations: select appropriate methods; make appropriate approximations; plausibility assess the results

Concrete goals

1. define electric and magnetic fields according to their force effect
2. explain the physical meanings of the differential equations for electrostatic and magnetostatic fields
3. calculate the electric field from the stationary charge distributions and magnetic fields from steady current distributions
4. solve simple electrostatic boundary value problems
5. describe and use simple models of electric and magnetic field interactions with materials
6. explain the concept of electromotive force
7. write down Maxwell's equations and explain their physical meanings
8. analyze how energy is transported in an electromagnetic field
9. analyze the propagation, reflection and transmission of plane waves under normal incidence
10. calculate the radiation fields from electric and magnetic dipoles

Course contents

- Coulomb's law; electric field E; charge distributions; Gauss' law
- scalarpotential; electrostatic energy; leader; capacitance
- method of images
- electricdipole; polarization; bound charges; D field; dielectrics; permittivity
- current density; conductivity; resistance; Joule's law
- Biot-Savart law, magnetic field B; continuity equation; Ampere's law; vector potential
- magnetic dipole; magnetization; bound current densities; H-field; permeability

- electromotive force; induction; inductance; magnetic energy
- Maxwell´s equations; Poynting´s theorem
- wave equation; plane waves; complex fields; plane waves in materials; reflection and transmission
- electric and magnetic dipole antennas

Disposition

Lectures and tutorial exercises.

Examination

- KONE - Examination E, 3.5 credits, grading scale: P, F
- KONM - Examination M, 4.0 credits, grading scale: P, F
- TEN1 - Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Passed in all examination moments.

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.