EI1240 Electromagnetic Theory 9.0 credits

Teoretisk elektroteknik

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 EI1240 valid from Autumn 2011

Grading scale

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

Education cycle

First cycle

Main field of study

Electrical Engineering,Technology

Specific prerequisites

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

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

- Mathematical methods in physics, including vector analysis, separation of variables and orthogonal functions

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 and momentum is stored and transported in an electromagnetic field
9. analyze the propagation, reflection and transmission of plane waves
10. analyze propagation in simple types of waveguides
11. use Maxwell's equations to analyze the electromagnetic fields generated by given dynamic charge/current distributions
12. calculate the radiation fields from simple types of antennas and antenna systems

Course contents

Part 1: Static fields
Electrostatics: Coulomb's law. Electric lines of force. Evaluation of electric field and potential in vacuum and with conducting and dielectric materials. Energy and forces in electrostatic systems. Boundary-value problems.
Static magnetic fields: Biot-Savart's and Ampere's laws. Fields in magnetic materials.

Part 2: Dynamic fields
Electromagnetic induction. Mutual and self-induction. Energy and forces in static and quasi-stationary fields. Maxwell's equations. Conservation laws. Plane waves. Wavesguides. Radiation and reception of electromagnetic waves. Transformation of electric and magnetic fields between systems with uniform velocity.

Disposition

Lectures and tutorial exercises.

Course literature

D. J. Griffiths: Introduction to Electrodynamics, 3:rd ed. (Prentice Hall).

Examination

- TEN1 - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination, 4.5 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.