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 Spring 2009

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

When the students have passed the course, they shall be able to

- define electric and magnetic fields
- calculate electric and magnetic fields from stationary and dynamic charge and current distributions
- solve simple electrostatic boundary
- describe simple models for electromagnetic interaction with media
- explain the physical meaning of Maxwell’s equations
- analyse energy and momentum in electromagnetic fields
- analyse plane waves and propagation in rectangular waveguides
- explain the meaning of retardation
- use Maxwell’s to calculate the fields from dynamic charge/current distributions
- calculate the fields from simple 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. Practical electrostatic problems. Energy and forces in electrostatic systems. Boundary-value problems. Method of images. 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: propagation, reflection and polarisation. 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

- KON1 - Control Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- KON2 - Control Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- KON3 - Control Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- KON4 - Control Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- TENA - Examination, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- TENB - Examination, 1.5 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.

The control tests are optional, and can give extra points to the written examinations. A passed written examination also results in pass in the corresponding control tests.

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.