EI1228 Electromagnetic Theory, Smaller Course 6.0 credits

Teoretisk elektroteknik, mindre kurs

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

Establishment

The official course syllabus is valid from. autumn semester 2026 as decided by the Director of First and Second Cycle Education. Decision date: 2026-04-10

Grading scale

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

Education cycle

First cycle

Main field of study

Electrical Engineering, Technology

Specific prerequisites

Knowledge of algebra and geometry, 7.5 credits, equivalent to completed course SF1624/SF1672.

Knowledge of single-variable analysis, 7.5 credits, equivalent to completed course SF1625/SF1673.

Knowledge of multivariable analysis, 7.5 credits, equivalent to completed course SF1626/SF1674.

Knowledge of electrical circuit analysis, 7.5 credits, equivalent to completed course EI1120, or knowledge of basic electromagnetism, 7.5 credits, equivalent to completed course SK1104.

Knowledge of vector analysis, 4.0 credits, equivalent to completed course ED1110 or SI1146. Active participation in ED1110 during period 1 of the same academic year is equated with completed course. Anyone who is registered is expected to and is considered to be actively participating.

Intended learning outcomes

After a pass mark on course, the student shall from a description of an electromagnetic problem be able to

- solve electrostatic problems by choosing correct method, analyse the problem with correctly applied theory and mathematical tools (vector algebra, integral calculus, approximations), to obtain and present correct results, and evaluate the plausability of the results.
- solve magnetostatic problems and induction problems by choosing correct method, analyse the problem with correctly applied theory and mathematical tools (vector algebra, integral calculus, approximations), to obtain and present correct results, and evaluate the plausability of the results.

Note that ’solve problems’ in the intended learning outcomes above means also that based on an appropriate part of Maxwell's equations by means of e g vector calculus, integral calculus and differential calculus be able to show how, in the electromagnetism, known expressions are related to one another. For example, Gauss law on integral form should be able to be derived based on the differential equation.

Course contents

Electrostatics:

- Coulomb's law; the electric field E; charge distributions; Gauss law, where fields are defined based on their force, calculate fields from given charge distriubutions
- the scalar potential; electrostatic energy; conductors; capacitance
- method of images, for boundary value problems,
- the electric dipole; polarisation; bound charges; The D-field; dielectrics; permittivity; the interaction of the electric field with material.
- current density; conductivity; resistance; Joule's law.

Magnetostatics and induction:

- Biot-Savart's law; the magnetic field B; the continuity equation; Ampère's law; the vector potential; The B-field defined from its force; calculate magnetic fields from a given stationary current density
- the magnetic dipole; magnetisation; bound current density; The H-field; permeability; magnetic field interaction with materials.
- electromotive force; the induction law; inductance; magnetic energy.

Examination

- KONE - Partial exam E, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- KONM - Partial exam E, 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.

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

KONE and KONM can be examined partly separately during the course and partly together in the examination period at the end of the course.

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.