



# El1228 Electromagnetic Theory, Smaller Course 6.0 credits

Teoretisk elektroteknik, mindre kurs

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

On 2020-04-21, the Head of School of EECS has decided to establish this official course syllabus to apply from the autumn semester 2020 (registration number J-2020-0317).

## Grading scale

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

## Education cycle

First cycle

## Main field of study

Electrical Engineering, Technology

## Language of instruction

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

## 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. E.g. Gauss law on integral form should be possible 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 distributions
- 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.

## Specific prerequisites

Completed courses equivalent to the courses in Engineering in energy and environment (CENMI) as well as in the education Master of Engineering & teachers (CLGYM) in

- linear algebra
- differential and integral calculus, in an and several variables
- analysis of electric circuits
- vector calculus.

## 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.

In agreement with KTH's coordinator for disabilities, it is the examiner who decides to adapt an examination for students in possess of a valid medical certificate. The examiner may permit other examination forms at the re-examination of few students.

## Transitional regulations

The previous examination TEN1 is replaced by KONE and KONM.

## 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.