EI1230 Electric Power Engineering I 8.0 credits

Elkraftteknik I

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

Establishment

This official course syllabus is valid from the autumn semester 2025 in accordance with decision by the director of first and second cycle education: HS-2025-0382.Date of decision: 02/03/2025

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Knowledge in linear algebra and analysis, 10.0 higher education credits, equivalent to completed course HF1006.

Knowledge in electromagnetism, 7.0 higher education credits, equivalent to completed course HE1027.

Language of instruction

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

Intended learning outcomes

After passing the course, the student should be able to

- calculate current, voltage and AC power in single-phase systems, and in balanced and unbalanced three-phase systems. Also more complicated calculations in three-phase system should be able to be solved by programming with complex numbers.

- describe equivalent circuits for operation of the transformer, the synchronous machine and the induction machine and use these in calculations of for example power, voltage drop and losses

- describe the operation of simple power electronic circuits such as phase control and rectification, and calculate the RMS value and mean for waveforms that arise in such circuits

- Describe at a general level for the design of the power grid including different voltage levels with their typical network topologies and methods for protection in fault situations, and examples of how renewable sources and sustainability requirements influence the power grid

- describe at the basic level the dangers that electricity can cause, methods that can protect against these faults and the regulatory framework for electricity safety in Sweden.

Course contents

- Power in alternating current circuits: RMS value, active power, reactive power, power factor, reactive compensation.

- Voltage drop, power transmission between voltage sources, short-circuit power.

- Three-phase system: principles and advantages, connections Y and D, formulas for balanced operation, single-phase diagrams, calculation for unbalanced case.

- The transformer. principle, formulas for ideal transformer; analysis by referred quantities equivalent circuit with magnetisation and losses; percentage impedance; the autotransformer; three-phase connection types

- Electric machines: calculations on the synchronous machine in operation as motor or generator; the principle and simple calculations on asynchronous and dc machines.

- Power electronics: diodes, thyristors and transistors; common applications for rectification and control; more about RMS value, mean and harmonics.

- The design of the power grid from low-voltage systems to the transmission network.

- Safety and protection: regulatory frameworks, dangers with electricity, protection against overcurrents and earth faults at different system levels.

Examination

- LAB1 - Laboratory tasks, 2.0 credits, grading scale: P, F
- PRO1 - Project work, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 4.0 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.

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.