FEJ3310 Design of Magnetic Components for Power Electronics 8.0 credits

Konstruktion av magnetiska komponenter för effektelektronik

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

Establishment

Course syllabus for FEJ3310 valid from Spring 2013

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

PhD students at KTH and PhD students from other universities.

Language of instruction

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

Intended learning outcomes

After completion of the course the student shall be able to

• explain the impact of physical limitations (such as magnetic saturation) on the design of magnetic components

• explain how the skin and proximity effects influence the design of magnetic components

• explain the properties of wire windings, foil windings, and litz-wire windings

• explain the properties of different core materials like laminated sheet steel, ferrites, powder iron, amorphous alloys, and nanocrystalline materials

• explain the differences in different design methods like saturated thermally-limited design and non-saturated thermally-limited design

• explain the properties of dc inductors, hf inductors, and combined dc/hf inductors

• calculate main physical dimensions like air-gap length, core cross-sectional area, winding cross-sectional area

• calculate the peak flux density for different waveforms of voltage and current

• calculate inductances and parasitic capacitances of magnetic components

• calculate frequency-dependent resistances and core losses of magnetic components

• calculate approximate values of fringing permeances of gapped inductors

• describe the magnetic design procedure for magnetic components

• describe thermal design procedure for magnetic components

• describe electric breakdown in air, in solid insulation, and corona discharge

• describe basic, supplementary, and reinforced insulation systems

• describe how inductance, capacitance, and loss measurements are performed

• describe methods for loss minimization

Course contents

Methods for design and analysis of inductors and transformers for power electronics.

Disposition

Seminars, lectures, project work, laboratory exercise, written examination.

Course literature

Alex Van den Bossche, Vencislav Cekov Valchev,
“Inductors and Transformers for Power Electronics”, CRC Press

Equipment

Laboratory equipment is provided by the Laboratory of electrical energy conversion.

Examination

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.

During the seminars the students should show that they are able to absorb the content of a section of the book and then present it in a professional way for the other students. The students should also show that they are capable of taking part in an advanced scientific discussion on the subject.

The project work is a design task where the whole content of the course is used. The result of the project work is evaluated in a laboratory exercise. The written examination is a standard examination with the grades P or F.

Other requirements for final grade

- At least one approved seminar with oral presentation
- An approved project work on a design task
- An approved laboratory exercise where the design is evaluated

An approved written examination.

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.