



# FEJ3221 Design of Permanent Magnet Synchronous Machines

## 9.0 credits

Konstruktion av permanentmagnetiserande synkronmaskiner

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 FEJ3221 valid from Spring 2012

### Grading scale

### Education cycle

Third cycle

### Language of instruction

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

### Intended learning outcomes

After the course, the student should be able to:

- list different existing topologies of permanent magnet machines
- describe and compare distributed and concentrated windings

- explain the principle of field-weakening for permanent magnet synchronous motors
- choose the appropriate permanent magnet materials for a given construction with regard to functionality, operating conditions, economic and environmental factors
- explain and compare the properties of iron laminations and soft magnetic composites in relation to their use in electrical machines
- enumerate different loss components in a machine and relate them to different existing models
- develop a simple analytical model of the thermal behaviour of a machine taking into account the relevant losses for the application
- explain all the tasks in the design procedure and apply them to a surface mounted permanent magnet motor with distributed windings with simplified analytical models
- explain discrepancies between results from different analytical methods through knowledge about the various approximations they are based on
- describe the concepts of finite element software tools and apply them in the analysis of permanent magnet synchronous machines
- report and present the results of the design project that has been conducted for a chosen application
- do a critical evaluation of the report and presentation of the specific studies conducted by the other students

## Course contents

Function and components of electric drive systems, application specifications, energy conversion in PM machines, torque derivation, loss, thermal constraints, modelling, permanent magnet materials, magnetic materials, topologies of PM machines (radial, axial and transverse), distributed and concentrated windings, field-weakening.

## Disposition

12 hours lecture, 2 hours tutorial, 82 (42+40) hours project, 15 hours project meetings

## Specific prerequisites

## Course literature

Course folder EJ2221 Design of Permanent Magnet Synchronous Machines, 2011.

## 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.

At least 1 full-time week of project activity is preferably linked to the student's own research.

## **Other requirements for final grade**

- 6 status reports
- 5 oral presentations
- 5 opposition reports
- Final report and oral 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.