# FSK3710 Spin Electronics 8.0 credits

## Spinnelektronik

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 FSK3710 valid from Spring 2018

## Grading scale

G

## Education cycle

Third cycle

## Specific prerequisites

**Prerequisites:**
Modern Physics/Introductory Quantum mechanics is required.

**Recommended previous knowledge:**
Solid State Physics (Kittel level) and Intermediate Quantum Mechanics (Griffiths level) are advantageous.

## Language of instruction

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

## Intended learning outcomes

The overall aim in this course is to understand the physical principles of magnetism and transport in nanostructures with a special emphasis on applications in spin-based memory and logic. A progressively better understanding means that after the course you are able to:

- identify different kinds of magnetism in solids, calculate the basic microscopic electronic parameters of materials given the necessary macroscopic characteristics, describe and calculate the main characteristics of the spin transport effects;
- compare/contrast materials with regards to their magnetic and transport properties, explain the causes of the main spin transport effects, analyze their relevance in relation to technological applications;
- theorize about the origins of magnetism and transport in solids aiming hypothetically at the ideal material(s) for spintronics, generalize device concepts as relates to spin transport, using the knowledge acquired in the course speculate about new transport devices based on spin.

## Course contents

- Normal and ferromagnetic metals
- Basic electron transport
- Giant Magnetoresistance
- Spin dependent tunneling
- Micromagnetic spin structure
- Electronic noise in magnetic materials and devices
- Materials for spin electronics: thin film and nano-fabrication techniques
- Spin-transfer torques, current induced switching
- Spin transport in semiconductors
- Spin-valve and spin-tunnel devices in data storage, Magnetic RAM, sensors.

## Course literature

V. Korenivski and J. C. Slonczewski, ”Introduction to Spintronics”.

Other handout material including research and review papers.

## Examination

- INL1 - Assignments, 6.0 credits, grading scale: G
- LAB1 - Laboratory work, 2.0 credits, grading scale: G

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.

## Other requirements for final grade

One lab exercise in charge transport measurements is required (LAB1, 2p, grading scale P/F).

The examination will be through home project assignments, presentation of a research paper in a journal club setting, participation in a brain-storming workshop on a topic relevant for the course, as well as an oral summative test of the course material (6p, P/F).

## 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.