



# FEI3332 Partial Discharge Physics and Measurement Techniques, PhD Course 8.0 credits

Partiella urladdningar - fysik och mätteknik, doktorandkurs

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 FEI3332 valid from Autumn 2011

## Grading scale

## Education cycle

Third cycle

## Specific prerequisites

MSc in electrical engineering, physical engineering or similar. FEI3230 and FEI3330 are complementary.

## 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:

- identify different sources of partial discharges in electrical insulation and describe their specific features
- describe the discharge process starting from a local gas ionization
- develop models of a partial discharge process with different levels of physical information
- compute the repetition patterns of partial discharges from physical models of the PD process
- analyze the information in PD signals on different time-scales
- measure partial discharges with different techniques
- describe how PD measurement circuits are calibrated
- analyze the particular features and severity of partial discharges in different power equipments such as cables, generators, transformers, bushings, capacitors, etc.
- describe how localisation of partial discharges can be made with electrical and acoustical time-of-flight techniques
- relate material degradation to partial discharge activity
- contribute to the research in the area

## Course contents

Fundamentals of partial discharges, gaseous ionization, partial discharge current waveform, apparent charge, physical degradation of insulation due to partial discharges, repetition of partial discharges under AC and DC voltage, calibration, physical models of PD and dynamic simulations in FEM, measurement techniques, PD sources in different equipment, cables, generators, transformers, bushings, capacitors, etc, localisation, acoustical methods

## Disposition

Lectures ( $12 \times 2\text{h} = 24\text{h}$ ), 4 homework problems, presentations by participants on solutions to homework problems ( $2 \times 4\text{h} = 12\text{h}$ ), 3 laboratory exercises: 1) phase resolved partial discharge analysis (PRPDA), 2) Localisation of partial discharges on a cable, 3) Partial discharges measured as non-linear dielectric loss and capacitance. 1 field measurement: generator. 72 h take home exam

## Course literature

D. König and Y. Naranya Rao, **Partial Discharges in Electrical Powere Apparatus, 1993**; Compendia: H.Edin, **Partial discharge physics and measurement techniques**, containing lecture notes, articles and selected chapters from other books.

## 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.

## Other requirements for final grade

Participated (short presentation every time) in 3 out of 4 homework problems. Accepted (80% correctness) solutions to 3 of 4 homework problems. Participated in 3 laboratory exercises and 1 field measurement. 60% correct on home exam.

## 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.