



FEI3380 The Lightning Flash and Lightning Protection, PhD Course 8.0 credits

Blixturladdning och åskskydd, 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 FEI3380 valid from Autumn 2011

Grading scale

Education cycle

Third cycle

Specific prerequisites

At least Bachelor's level electromagnetic field theory

Language of instruction

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

Intended learning outcomes

By the end of the course, the student should be able to:

- Describe the general structure of thunderclouds and the different types of lightning discharges
- Describe the various processes within a lightning discharge such as upward and downward leader discharges and dart leaders, stepped leaders, return strokes, continuing currents etc.
- The important parameters of lightning discharge and damage mechanism to objects
- Familiarize with the measuring techniques of lightning-generated electric and magnetic fields
- Understand the lightning attachment process and the different lightning interception models
- Describe the differences between laboratory experiments, rocket triggered lightning, natural lightning, tower-initiated upward lightning.
- Estimate the electromagnetic fields generated by lightning and various computational models
- Understand the field-to-transmission line coupling models for induced voltage calculations
- Describe the effect of ground conductivity and other design parameters in the voltages induced by lightning strikes
- Understand the different principles of protection of structures against lightning
- Familiarize with the international standard on lightning protection
- Design a lightning protection system for a simple structure
- Describe the electrical aspects of lightning strikes to humans

Course contents

Lightning flash and lightning protection theory.

- Charge structure and geographical variation of thunderclouds
- The mechanism of the lightning flash and lightning phenomenology
- Lightning parameters of engineering interest
- Rocket triggered and tower-initiated lightning experiments
- Lightning attachment to ground-based structures
- Computation of electromagnetic fields from lightning discharge
- Mathematical models of return strokes
- Interaction of electromagnetic fields generated by lightning with overhead electrical networks
- Lightning and EMC
- Protection of structures against lightning: external and internal lightning protection systems

- Grounding and lightning protection
- Lightning protection of power lines and low voltage networks
- Lightning protection of wind turbines, telecommunication towers, boats etc.
- Lightning protection of structures with risk of fire and explosion
- Lightning-caused injuries in humans

Disposition

Lessons 30 h

Course literature

Chapters from Rakov and Uman, *Lightning: Physics and Effects*, Cambridge University Press, New York (2003); Chapters from Cooray (ed), *The Lightning Flash*, IEE Publication, London (2003); Chapters from Cooray (ed), *Lightning Protection*, IET Publication, London (2010), Journal Papers

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

Written examination, a simulation exercise report. Oral presentation of one subject.

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.