EI2435 Power Grid Technology and Components 7.5 credits

Elnätsteknologi och ställverksutrustning

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

The official course syllabus is valid from the autumn semester 2021 in accordance with head of school decision: J-2021-0562.Decision date: 2021-04-15.

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge in linear algebra and analysis, 10.0 higher education credits, equivalent to completed course HF1006.

Knowledge in electromagnetism, 7.0 higher education credits, equivalent to completed course HE1027.

Knowledge in signals, systems and transforms, 8.0 higher education credits, equivalent to completed course HF1011.

Knowledge in power engineering I, 8.0 higher education credits, equivalent to completed course HE1032.

Knowledge in mathematical statistics, 6.0 higher education credits, equivalent to completed course HF1012.

Active participation in a course offering where the final examination is not yet reported in LADOK is considered equivalent to completion of the course.

Registering for a course is counted as active participation.

The term 'final examination' encompasses both the regular examination and the first re-examination.

Language of instruction

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

Intended learning outcomes

After passing the course, the student shall be able to

- give an account of the purpose and fundamental function of different power components and how they are designed
- make computing models for components that can be used for calculation of:

the propagation of transients in the power system,

transient and stationary short-circuit currents and associated induced overvoltages at different short circuit scenarios,

transient overvoltages and currents in different switching situations. The models should be possible to be applied on both linear systems and non-linear, e.g. treatment of ferroresonance,

transient stress distributions in components with geometric extent e.g. windings in transformers

- give an account of different types of system neutral grounding and their advantages and disadvantages
- give an account of different methods for protection against overvoltages
- calculate probabilities that a certain overvoltage gives breakdown of the (insulation co-ordination)
- give an account of which properties that influence the reliability of the power components, accessibility and life

- give an account of the different strains and material properties that influence the design of a power component with respect to thermal, electric and mechanical dimensioning
- give an account of how components are influenced by surrounding environment and how they influence their local environment
- give examples of how laws, regulations and standards influence the design of the power system
- give an account of the most common aging mechanisms and the causes of faults in electric devices and which methods that can be used to clarify if an equipment is aged and therefore run increased risk for faults.

Course contents

Electric power system: from producer to consumer - historical overview and technical progress

The principles behind transfer with high-voltage alternating current (HVAC) or DC-voltage (HVDC)

The architecture of the power system, included components, their fundamental function and design

Laws, regulations and standards that control the power system

Switchgear and substations

Components: breakers, switches, reactors, capacitors, conductors, transmission lines, cables, power electronics, transformers (power and instrument), generators, recitifiers, FACTS, insulators, bushings etc

Insulation and insulators: free air, capsuled with SF6 as insulation medium

Computing models for transient processes, connections and disconnections, lightning and switching overvoltages, fault currents, oscillations and resonances.

System neutral ground

Protective relay

Measuring equipment

Control and supervision

Insulation coordination

Reliability, accessibility and service life characteristics. Aging phenomenon.

Maintenance strategies

Methods for state supervision and diagnostics

Examination

- PROA - Project, 1.0 credits, grading scale: P, F
- PROB - Project, 1.0 credits, grading scale: P, F
- PROC - Project, 1.0 credits, grading scale: P, F
- TENA - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F

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.

The exam is written.

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.