



# **EI2436 Power Grid Technology and Substation Design 6.0 credits**

**Elnätsteknologi och ställverkskonstruktion**

This is a translation of the Swedish, legally binding, course syllabus.

## **Establishment**

Course syllabus for EI2436 valid from Spring 2019

## **Grading scale**

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

## **Education cycle**

Second cycle

## **Main field of study**

Electrical Engineering

## **Specific prerequisites**

120 hp and English B or equivalent.

EJ 1200 Electric power system or similar.

## **Language of instruction**

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

## Intended learning outcomes

After fulfilment of all course requirements, the student should be able to

- describe the purpose, need, principle function and design of different power components
- make mathematical models that can be used for calculation of:
  - propagation of over-voltage transients in the power system.
  - transient and stationary short-circuit currents and related induced overvoltages for different fault situations.
  - transient overvoltages and currents in different connection/disconnection situations.

The models should be applicable on linear as well as non-linear systems and components, as for example treatment of surge arresters and magnetic cores.

- transient voltage distributions in components of distributed nature like transformer windings and cables.
- describe different type of neutral groundings
- describe different methods for overvoltage protection
- calculate different probabilities that a certain overvoltage cause breakdown (insulation coordination)
- understand which properties that has an impact on the reliability, availability and life-time of the power components
- present an overview of possible stresses on power components and understand the relation between stresses, dimensioning (thermal, electrical, ambient and mechanical) and material selection.

One should know how the power components are affected by their surrounding environment and vice versa.

One should have some insight in the laws, regulations and standards that affects the design of a power system.

- discuss the most common mechanisms behind long-term ageing of power apparatus and propose diagnostic methods that can be used in order to detect the ageing.

## Course contents

The electric power system: from producer to consumer – an historical overview and technical progress

Principles behind power transmission with high voltage alternating currents (HVAC) and high voltage direct currents (HVDC)

The design of a power system, required components, their principle function and design

Laws, regulations and standards behind a power system

Substations and switchyards

Komponenter: brytare, frånskiljare, reaktorer, kondensatorer, avledare, luftledningar, kablar, kraftelektronik, transformatorer (kraft och mät), generatorer, likriktare, FACTS, isolatorer, genomföringar etc.

Components: breakers, disconnectors, reactors, capacitors, surge arresters, overhead lines, cables, power electronics, transformers (power, measurement), generators, rectifiers, FACTS, insulators, bushing, etc.

Insulation and isolators: Free air, GIS, solids etc.

Calculation models for transient conditions, connection/disconnection, lightning- and switching overvoltages, fault currents, oscillations and resonances

Neutral grounding

Relay protection

Measuremet equipment

## Course literature

Preliminär kurslitteratur:

Kurspärm, "Power grid technology and substation design"

Utdrag ur handböcker

Standarder

Konferens- och tidskriftsartiklar

The final course literature is decided at latest 4 weeks before course start and is informed on the course homepage and by e-mail to registered students.

## Examination

- PRO1 - Project, 1.5 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.

If the course is discontinued, students may request to be examined during the following two academic years.

## Other requirements for final grade

Minimum grade E on TEN A and Pass (P) on PRO 1

## **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.