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

Course syllabus for EI2435 valid from Autumn 2011

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Basic courses (compulsory) in electrical engineering, EJ1200 Electric Power Systems or equivalent, and Eng B or equivalent.

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 puropose, 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)
- understard which properties that has an impact on the reliability, availiability 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 apparatuse 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.

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

Neutral grounding

Relay protection

Measuremet equipment

Mätutrustning

Control and monitoring equipment

Insulation coordination

Reliability, availability and life-time properties. Ageing.

Maintenance and methods for condition based maintenance (CBM).

Course literature

Compendia, H.Edin, "Power grid technology and components" , KTH, 2011.

Excerpts from:

Handbooks

Standards

Articles

Examination

- PRO1 - Project 1, 1.5 credits, grading scale: P, F
- PRO2 - Project 2, 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.

Other requirements for final grade

Written exam, TENA 4,5 p

Project 1, PRO1, 1,5p

Project 2, PRO2, 1,5 p

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.