



EI2455 Smart Electrical Networks and Systems 7.5 credits

Smarta elektriska kraftnät och system

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 EI2455 valid from Autumn 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Basic courses in electrical engineering
EJ1200 Electric Power Systems
EG2020 Power Systems, Basic Course
EJ2301 Power Electronics, or the equivalent knowledge

Language of instruction

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

Intended learning outcomes

Having passed the course, the student should be able to:

- account for advantages and possibilities that the intelligent electric power grid can achieve both technically and commercially
- account for how distributed and fluctuating electricity production influences the design of the electric power distribution network
- account for which methods that can be used for supervision and diagnostics of electric power devices and how these methods can give increased reliability in the electricity supply
- analyse the consequences of different transmission methods for electric energy
- analyse which influence fast measurements and data collection have on the controlling properties of the intelligent electric power grid
- make qualitative and quantitative comparisons between different technologies based on conventional technology and power electronics
- be able to make models for calculation of the consequences for small-scale generation, energy storing as well as changed electricity consumption due to increased use of intelligent control, solar cells and heat pumps etc as well as electric vehicles that are loaded from the power grid but that can also intermittently deliver electricity back to the grid
- have a conception of which factors and aspects that control the design of the electric power grid.

Course contents

You will apply your electrical engineering skills on fields that are of relevance in the field that is called 'intelligent electrical power grids'. You will also be acquainted with basic concepts in innovation and enterprise around technical innovations in this field.

Module 1 and Project 1

Intelligent Electric Power Grids as general concepts

Module 2 and Project 2

Power generation from renewable energy sources. Analysis of the effect of the power grid on: electricity production on all voltage and power levels, increased part distributed generation, higher part fluctuating energy sources e.g. wind and sea-wave power. Principles for energy storage and transformation between energy forms e.g. batteries, flywheels, compressed air etc. The flexible distribution system. Effect of large-scale renewable generation, improvement of energy efficiency in large-scale facilities, new components in the distribution system.

Module 3 and Project 3

Intelligent power grids on consumer level. Effect of IT and communication solutions. Effect on own generation, optimised electricity usage, electric vehicles etc

Module 4 and Project 4

The flexible HVDC transmission system. Transfer with HVDC, Thyristor-HVDC, IGBT-HVDC, UHVDC.

Disposition

The course is organised around four modules that take place on various occasions during the academic year. In connection with each module, you will carry out a project that highlights a number of aspects around intelligent power grids.

Course literature

J. Ekanayake et al, INTELLIGENT GRID, Technology and Applications, Wiley, 2012.
(E-book)

Stuart Borlase (oath), Intelligent Grids, Infrastructure, Technology, and Solutions, CRC Press 2012 (E-book)

Distributed articles etc

Examination

- PROA - Project, 1.0 credits, grading scale: A, B, C, D, E, FX, F
- PROB - Project, 2.7 credits, grading scale: A, B, C, D, E, FX, F
- PROC - Project, 1.0 credits, grading scale: A, B, C, D, E, FX, F
- PROD - Project, 2.8 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.

Students who have not completed earlier course occasion are assessed by carrying out the home assignments and projects that applied when they read the course.

In agreement with KTH's coordinator for disabilities, it is the examiner who decides to adapt an examination for students in possess of a valid medical certificate.. The examiner may permit other examination forms at the re-examination of few students

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.