LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Elkraftsystem
Electric Power Systems

EIEN15, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED E
Date of Decision: 2023-04-11

General Information

Elective for: E4-em, E4-ra, F4, F4-es, M4-en, W5-et, MHET2
Language of instruction: The course will be given in English on demand

Aim

Historically electric energy has been very important for our prosperity. A key part of the ongoing climate transition is the energy transition, where fossil energy is replaced by electric energy from renewable sources. This supports increased electricity use for electrification of road transports and industrial processes. Wind power and solar PV differ from traditional electricity generation by being weather-driven and thus variable and also by having power electronic grid interfaces. The electric power system is now evolving rapidly to manage the associated challenges to planning and operation. Capacity limits are handled with both traditional grid reinforcement and with automatic control of flexible generation and flexible consumption.

The course explains the design and properties of the electric power system during normal operation and during faults, and the impact of renewable generation. Central issues are possible control options during operation and how different types of instability limit power transfer capacity. The contents are lectured and studied through numeric exercises and practical laboratory tests that are preceded by computer simulations. The industrial computerized analysis of large systems is thus introduced, but is combined with calculations by hand to review and interpret computer results.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to formulate simple models of an electric power system for computation of load flow and symmetric and asymmetric fault currents;
- be able to describe the calculation process of a computer programme for the calculation of load flow;
- be able to calculate symmetric and asymmetric fault currents for a simple model of an electric power system;
- be able to formulate stability criteria for a simple power system model;
- understand the meaning of selectivity for a relay protection system.

Competences and skills
For a passing grade the student must

- be able to carry out computer calculations of fault currents, stability, and load flow for non-trivial power system models;
- be able to evaluate computer calculations of fault currents, stability, and load flow by hand calculations.

Judgement and approach
For a passing grade the student must

- show insight into the possibilities and limitations of the electric power system and its role in society.

Contents

- Construction and function of key components. Power electronic control and compensation;
- System representation: Single line diagram. Symmetrical components. Per unit normalization. Short-circuit MVA;
- System characteristics during normal operation, short-circuits, asymmetry and resonance. Angle and voltage stability. Computer dynamic simulations and load flow calculations. Control of voltage, frequency, active and reactive power. Relay protection;
- Study visit.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exam (5h) of problem solving mixed with theory questions.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0112. **Name:** Electric Power Systems.
Credits: 7,5. **Grading scale:** TH.
Code: 0212. **Name:** Laboratory Work.
Credits: 0. **Grading scale:** UG.

Admission

Assumed prior knowledge: ESS060, ESSF15 Electrical Engineering or MIE012, EIEF35 Electrical Engineering, basic course, or ETE115, EITF90 Electromagnetics and

electronics.
The number of participants is limited to: No
The course overlaps following course/s: EIE030

Reading list

- Glover, J. D., Overbye, M., Sarma, M., Birchfield A.: Power System Analysis and Design, 7th SI Edition. Cengage Learning, UK, 2023, ISBN: 978-0-357-67619-6.
- J. D. Glover, T. Overbye, M. Sarma: Power Systems Analysis and Design, 6th SI edition. Cengage Learning, UK, 2016, ISBN: 9781305636187. Most recent edition available: · J. D. Glover, T. Overbye, M. Sarma: Power System Analysis and Design, Cengage Learning, UK, 2016, 6th SI edition ISBN-13: 9781305636187. J. D. Glover, T. Overbye, M. Sarma, A. Birchfield: Power System Analysis and Design, Cengage Learning, UK, 2023, 7th SI edition ISBN-13: 9780357676196.

Contact and other information

Course coordinator: Professor Olof Samuelsson, olof.samuelsson@iea.lth.se
Course homepage: https://www.lth.se/iea/utbildning/valfria-kurser-i-lund/elkraftsystem/