T-866-HIVO **HIGH VOLTAGE ENGINEERING** **8 ECTS**

Year of study: First year MSc.
Semester: Spring.
Level of course: 5. Second cycle, intermediate.
Type of course: Core for MSc Electrical Power Engineering, elective for other programs.
Prerequisites: No prerequisites.
Schedule: Runs for 12 weeks – 6 teaching hours a week.
Supervisor: Ragnar Kristjánsson.
Lecturer: NN.

Learning outcome:

Knowledge: By the end of the course the students will be able:

- to understand basic concepts and phenomena relevant to dimensioning and evaluation of high voltage (HV) components with regard to electrical, electro-mechanical, and thermal stress of insulators and conductors,
- to identify key component's parameters and define critical quantities/figures of HV components,
- to examine the influence of the identified component's parameters on the critical quantities/figures,
- to differentiate and subsequently prioritise the critical figures with regard to safe and reliable operation of a particular component/insulator, as well as
- to reliably estimate values and uncertainties of relevant figures.

Skills: By the completion of the course the students should be able:

- to identify electric field characteristics (as well other related quantities, e.g., temperature, pressure, current, etc.,) and material parameters appropriate for a particular HV problem,
- to use analytical methods to estimate: HV components/insulation characteristics, potential relief in the electric stress due to proper component dimensioning/grading, possible value of electric field build up due to insulation defects,
- to develop, modify and, use finite-difference numerical codes for computing and visualization of electric fields and voltage distributions,
- to set up and use electric schematic evaluators for steady-state and transient thermal analyses and ampacity evaluation of HV cables,
- to simulate electric stress using CST EM studio,
- to make a state of the art review on a particular HV problem using available databases (e.g., ieeexplore), as well as to evaluate reliability of the available formulas and approaches for HV problems.

Competence: By the completion of the course, the students should have developed a basic vision of existing methods and tools relevant to design and analysis of HV components/insulators.

Completion of the course assignments requires the student (a) to elaborate the work plan for every assignment, (b) to list modelling approximations/assumptions, (c) to define the figures of interest, (d) to configure evaluation tools, (e) to interpret the evaluation results, (f) to present the completed assignment in the form of a report describing the problem formulation, description of methods, results, conclusion, and bibliography.

Content:
• Electric field characteristics. Analytical estimation of electric fields.
• Numerical computing of voltage distributions and electric fields using Finite-Difference codes. Numerical solving of Laplace Equation.
• Numerical analysis of E-fields using CST EM Studio.
• Generation of DC, AC and impulse high-voltages.
• Measurement of DC, AC and impulse high-voltages.
• Breakdown in gases, liquids, and solid dielectrics. Application of insulating materials in electrical components. Design of insulators.
• Overvoltage phenomenon.

Reading material: Will be introduced in the learning management system Canvas at the beginning of the semester.
Teaching and learning activities: Lectures and practical (project) sessions.
Assessment methods: Projects (incl. project reports): 3 x 25% = 75%; Subject reviews (incl. ppt-presentations): 2 x 12.5% = 25%.
Language of instruction: English.

All course descriptions may be subject to change. Updated information on the course schedule, reading material, teaching and learning activities, and assessment methods will be introduced in the learning management system Canvas at the beginning of the semester.