Module Description

High Voltage Engineering

General Information

Number of ECTS Credits

3

Abbreviation

TSM_HiVoEn

Version

27.1.2017

Responsible of module

Prof. Dr. Joseph Moerschell, HES-SO

Language

	Lausanne	Bern	Zurich
Instruction	☐ E ☒ F	☐ D ☒ E ☐ F	☐ D ☒ E
Documentation	☒ E ☒ F	☐ D ☒ E ☐ F	☐ D ☒ E
Examination	☒ E ☒ F	☐ D ☒ E ☐ F	☐ D ☒ E

Module category

☐ Fundamental theoretical principles - FTP
☒ Technical/scientific specialization module - TSM
☐ Context module - CM

Lessons

☒ 2 lecture periods and 1 tutorial period per week

Brief course description of module objectives and content

This module offers a comprehensive introduction into high voltage engineering, its relevant design problems, modern simulation based solution methods, and state-of-the-art testing techniques.

Aims, content, methods

Learning objectives and acquired competencies

After successfully completing this course the student possesses the fundamental knowledge of the high voltage engineering that is sufficient for its successful application in daily design and product development. Additionally, the student has become acquainted with the static/dynamic modeling and simulation of high voltage components. He has also gained considerable experience with at least one modern commercial simulation tool (Infolytica, ANSYS or COMSOL) and can efficiently use the simulation software in order to solve practical design problems.

Contents of module with emphasis on teaching content

1. Fundamentals high voltage engineering (4 weeks)
    a. Generation of high voltages (DC, AC, and impulse voltages)
    b. Measurement of high voltages
    c. Electric fields and field stress control
    d. 2-D and 3-D numerical simulations of electric field
    e. Insulation coordination
2. Electric breakdown in gases, solids and liquids (3 weeks)
    a. Classical gas laws, ionization and decay process, cathode processes
    b. The streamer mechanism of spark
    c. The sparking voltage – Paschen's law
    d. The breakdown field strength and corona discharges
    e. Breakdown in solids and liquids
3. Non-distructive insulation testing (4 weeks)
    a. LI-measureremements
    b. AC-measurements
    c. High voltage dielectric loss and capacitance measurement
    d. Partial-discharge measurement
    e. Calibration of PD-detectors
4. HV-cables and circuit breakers(3 weeks)
    a. Field control
    b. Cable termination
    c. Nonlinear (semi-conductive) insulation materials
    d. Circuit breaker technologies

Teaching and learning methods

Ex cathedra, practical exercises and case studies.

Prerequisites, previous knowledge, entrance competencies

Knowledge of electric charge, electric field, and ordinary- and partial differential equations.

Literature

1. A. Küchler, „Hochspannungstechnik", Springer Verlag, Berlin, 2009.
2. A.M. Faraouk, T. N. Giao, "High Voltage Engineering", CRC Press, Boca Raton, USA, 2014.

Assessment

Certification requirements for final examinations (conditions for attestation)

None

Written module examination

Duration of exam:	120 minutes
Permissible aids:	Lecture notes