

**Module Description, available in: EN**

## High Voltage Engineering

**General Information****Number of ECTS Credits**

3

**Module code**

TSM\_HiVoEn

**Valid for academic year**

2019-20

**Last modification**

2018-11-08

**Coordinator of the module**

Joseph Moerschell (HES-SO, joseph.moerschell@hevs.ch)

**Explanations regarding the language definitions for each location:**

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Berne	Lausanne	Lugano	Zurich
<b>Instruction</b>	X E 100%			
<b>Documentation</b>	X E 100%			
<b>Examination</b>	X E 100%			

**Module Category**

TSM Technical scientific module

**Lessons**

2 lecture periods and 1 tutorial period per week

**Entry level competences****Prerequisites, previous knowledge**

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

**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 competencies to be acquired

After successfully completing this course the student possesses a fundamental knowledge of high voltage engineering, sufficient for its successful application in daily design and product development. Additionally, the student has become acquainted with the static/dynamic modelling 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.

### Module content with weighting of different components

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

### Teaching and learning methods

Ex cathedra, practical exercises and case studies.

### Literature

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

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

**As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.**

### Standard final exam for a module and written resit exam

#### Kind of exam

Written exam

#### Duration of exam

120 minutes

#### Permissible aids

*Aids permitted as specified below:*

#### Permissible electronic aids

Pocket science calculator

#### Other permissible aids

Lecture notes

**Special case: Resit exam as oral exam**

**Kind of exam**

Oral exam

**Duration of exam**

30 minutes

**Permissible aids**

*Aids permitted as specified below:*

**Permissible electronic aids**

Pocket science calculator

**Other permissible aids**

Lecture notes