

Module Description, available in: EN

High Voltage Engineering

General Information

Number of ECTS Credits

3

Module code

TSM_HiVoEn

Valid for academic year

2019-2020

Last modification

2018-11-08

Responsible of module

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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
Instruction	X E 100%			
Documentation	X E 100%			
Examination	X E 100%			

Module Category

TSM Technical/scientific specialization 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 acquired competencies

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.

Contents of module with emphasis on teaching content

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. Giao, “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 the standard final exams for modules and also all repetition exams are to be in written form

Standard final exam for a module and written repetition exam

Kind of exam

written

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: Repetition exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

Pocket science calculator

Other permissible aids

Lecture notes