

Course Manual HSUT

High Voltage Transmission Technology

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– General information

Long name	High Voltage Transmission Technology
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Approving CModule	<u>HSUT_MaET</u>
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Responsible	Prof. Dr. Christof Humpert <small>Professor Fakultät IME</small>
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Valid from	summer semester 2021
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Level	Master
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Semester in the year	summer semester
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Duration	Semester
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Hours in self-study	60
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ECTS	5
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Professors	Prof. Dr. Christof Humpert <small>Professor Fakultät IME</small>
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Requirements	Basics of electrical engineering and electronics Basic understanding of electric fields in dielectrics
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Language	German
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Separate final exam	No
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Literature

Küchler, Andreas: Hochspannungstechnik:
Grundlagen – Technologie – Anwendung

Heuck, Klaus; Dettmann, Klaus-Dieter; Schulz,
Detlef: Elektrische Energieversorgung

– Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	<p>Overvoltages and insulation coordination</p> <ul style="list-style-type: none"> - Generation and categories of overvoltages - Propagation of overvoltages - Traveling waves - Reflections - Limitation of overvoltages - Types of surge arresters - Properties, structure and selection <p>Systems of high voltage transmission</p> <ul style="list-style-type: none"> - High-voltage AC transmission (HVAC) - Optimal transmission voltage - Structure and different types of switchgears, their properties and applications - High-voltage DC transmission (HVDC) - Advantages and disadvantages in comparison to HVAC - Structure and operation of converter stations - Cost comparison to HVAC systems - HVDC grids <p>Equipment of high voltage transmission</p> <ul style="list-style-type: none"> - Circuit breakers - Principle of operation - Different Types and their applications - Circuit breakers for HVDC - Superconducting equipment (cables, current limiters) - Principle of operation and applications - Cooling technology - Losses and costs

Special requirements

none

Accompanying material	electronic presentation documents electronic articles for self-study electronic exercise task collection
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Separate exam	Yes
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Separate exam

Exam Type	undefined
Details	Structured oral examination: <ul style="list-style-type: none"> - Discussion of advantages and disadvantages of current and future technologies with regard to the requirements of transmission systems - Calculations of voltage stress in nominal and fault cases - Discussion of suitable measures to reduce the stresses - Simplified profitability calculations
Minimum standard	60 % correct answers

Skills

- Determine the stresses of transmission systems
- Calculate operating voltages and overvoltages for a given voltage level
 - Plan limitation of overvoltages
 - Analyze and calculate traveling wave processes (refraction, reflection)
 - Derive current carrying capacity and maximum losses

- Determine business aspects
- Carry out investment cost comparison
 - Perform operating cost comparison

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	2
Exercises (shared course)	0
Tutorial (voluntary)	0

– Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Electric field calculation at AC and DC Influence of material properties and frequency of applied voltage
Skills	Solve project task in the team Compile the basics of a calculation software Perform numerical calculations Compare numerical results with analytical Discuss results related to practical application Summarize results in a report

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Project	0
Tutorial (voluntary)	0

Special requirements

none

Accompanying material	Description of the project task Instructions for the calculation software
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Separate exam	Yes
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Separate exam

Exam Type	EN Projektaufgabe im Team bearbeiten (z.B. im Praktikum)
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Details	Evaluation of the project report
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Minimum standard	80% of the calculation results correct 70% of the evaluation performed correctly 70% of the discussion makes sense
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– Practical training

Learning goals

Goal type	Description
Knowledge	Generation and measurement of AC, DC and impulse voltages Propagation and limitation of overvoltages
Skills	Plan high voltage tests Dimension high voltage test circuits Determine test criteria for components of high voltage technology Summarize results in a report

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0

Special requirements

none

Accompanying material Lab exercise manual

Separate exam Yes

Separate exam

Exam Type EN Projektaufgabe im Team bearbeiten (z.B. im Praktikum)

Details Observation of the lab exercises performed largely independent
Evaluation of reports of the lab exercises

Minimum standard 80 % of the measurement results correct
70 % of the evaluation performed correctly
70 % of the discussion makes sense