COURSE DESCRIPTION CARD

Faculty of Electrical Engineering									
Field of study	Electrical and Electronics Engineering							Degree level and programme type	bachelor's degree, full time programme
Specialization/ diploma path	-							Study profile	-
Course name	High Voltage Technique							Course code	IS-FEE-10034S
								Course type	elective
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	summer
	30		30					No. of ECTS credits	6
Entry requirements	-								
Course objectives	The principal objective of lectures is to cover the fundamentals of high-voltage test technique, generation and measurement of high voltages, electrical breakdown in gases, solid and liquid dielectric, travelling waves in high voltage lines, lightning and overvoltage protection and topresent the basics of high voltage insulation design.Skills of performing measurements, tests and studies on high voltage generators, electrical withstand of insulators and insulating materials and measurements of high voltages and high currents. Skills of safe work with high voltage electrical devices and apparatus.								
Course content	Lecture High voltage test technique. Generation and measurement of high alternating and direct voltages. Generation and measurements of impulse voltages and currents. Dielectric loss and capacitance measurements. Partial discharge measurements. Disturbances in high voltage laboratory. Electrical breakdown in gases, solid and liquid dielectric. Travelling waves in high voltage lines. Reflection of travelling waves. Reflection of travelling waves against transformers. Lightning, mechanism, philosophy of protection, lightning protection of structures. Lightning and switching transients in power system. Protection against overvoltages. Surge protective devices. Insulation coordination. Construction elements for high voltage circuits. High voltages cables and capacitors. Design, materials and testing. High voltage Transformers. Materials and testing. External insulation. Design and testing. Laboratory class Measurement of voltage distribution across an insulator string. Measurements of electrical withstand of air subjected to high voltage of AC, DC and surge type. Methods of measurement of high voltages. Investigation of surge generators. Investigation of oil insulation.								
Teaching methods	lecture and multimedia presentation, experiments in laboratory class								
Assessment method	lecture: final written test; laboratory class: evaluation of reports, verification of preparation for classes.								
Symbol of learning outcome	Learning outcomes								Reference to the learning outcomes for the field of study
LO1	develop an in-depth understanding and technical competence of HV test techniques, especially								

	generation and measurement of high AC, AC and impulse voltages and impulse currents, partial discharge, dielectric loss and capacitance measurements; plans, selects appropriate equipment and performs measurement of high surge voltages and surge currents;	
LO2	develop an in-depth technical competence in lightning and overvoltage protection of structures;	
LO3	develop an in-depth understanding of electrical breakdown and withstand of gas, liquid and solid insulators or insulating materials; performs measurements and tests on electrical withstand of gas, liquid and solid insulators or insulating materials;	
LO4	develop an in-depth understanding in the area of lightning power systems protection; achieve a thorough knowledge and technical competence in a wide range of lightning and switching overvoltage protection in HV power station, HV lines and insulation coordination;	
LO5	develop an in-depth understanding of the theory and applications in power systems of High Voltage Direct Current (HVDC) transmission and Flexible AC Transmission Systems (FACTS);	
LO6	define and characterizes methods of generation and measurement of high voltages and high currents; describes basic characteristics and methods of investigation of electrical withstand of gas, liquid and solid insulators; plans, selects appropriate equipment and performs measurement of high voltages;	
LO7	elaborates, illustrates, interprets and compares obtained measurement or test results and draws aproprate conclusions;	
LO8	applies rules of safety and hygiene of work with high voltages; can work in a team.	
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	exam on lecture contentverification of preparation for laboratory classe	L, LC
LO2	exam on lecture content	L
LO3	exam on lecture contentverification of preparation for laboratory classe	L, LC
LO4	exam on lecture content	L
LO5	exam on lecture content	L
LO6	exam on lecture contentverification of preparation for laboratory classe	L, LC
LO7	work on reports from laboratory classes	LC
LO8	participation in student-teacher sessions related to the classes	LC
Student workload (in hours)		No. of hours
Calculation	lecture attendance	30
	participation in laboratory classes	30

	preparation for laboratory classes	18
	work on reports from laboratory classes	24
	participation in student-teacher sessions related to the lecture	5
	participation in student-teacher sessions related to laboratory classes	5
	preparation and performance of presentation on selected topic	14
	preparation for and participation in exam	24
	TOTAL:	150

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	74	2,5
Student workload – practical activities	77	3

Basic references	1. Naidu M.S., Kamaraju V.: High voltage engineering. Mc. Graw Hill, 2003. 2. Holzhauen J. P., Vosloo W. L.: High voltage engineering. Practice and theory. Mc. Graw Hill, 2009. 3. Cooray V.: Lightning protection. IEEE, 2009. 4. Kuffel E., Zaengl W. S., Kuffel J.: High voltage engineering fundamentals. Newness, 2000. Wadhwa C. L.: High voltage engineering. New Age International Publishers, 2007.
Supplementary references	1. Kind D., Feser K.: High voltage test technique. Newness, 2001. 2. Cooray V.: The lightning flash. IEEE, 2004. 3. Beyer M., Boeck W., Moeller K., Zaengl W.: Hochspannungstechnik. Theoretische und praktische grundlagen für die anwendungen. Springer, 1989. 4. Zulkurnain A.: Fast transient response of high voltage surge arrester. VDM, 2010. 5. Hasse P., Wiesinger J., Zischank W.: Handbuch für blitzschutz und erdung. Pflaum, 2006.

Organisational unit conducting the course	Department of Photonics, Electronics and Lighting Technology	Date of issuing the programme
Author of the programme	Renata Markowska, Ph.D. Eng.	07.02.2020

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work,

S – seminar